# Rhodora

JOURNAL OF THE

## NEW ENGLAND BOTANICAL CLUB

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Conducted and published for the Club, by

REED CLARK ROLLINS, Editor-in-Chief

ALBERT FREDERICK HILL
STUART KIMBALL HARRIS
RALPH CARLETON BEAN
RICHARD ALDEN HOWARD
CARROLL EMORY WOOD, JR.
} Associate Editors

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The New England Botanical Club, Inc.

8 and 10 West King St., Lancaster, Pa.

Botanical Museum, Oxford St., Cambridge 38, Mass.

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## AUTHORSHIP AND NOMENCLATURE OF BUR CLOVERS (MEDICAGO) FOUND WILD IN THE UNITED STATES


Lloyd H. Shinners


Few genera have accumulated a literature so abounding in misquotations, misinterpretations, and misapplications as *Medicago*. The only monograph, the preliminary one by Urban, was published more than eighty years ago. Only a small fraction of the synonymy is included by that author, and his taxonomic treatment is more often a cataloguing of morphological types than a delimitation of biological entities. The same can be said of most of the Old World floras. Lowe's *Manual Flora of Madeira* is almost unique in supplying field observations, and synonymy in critical detail. Recent European floras (e. g., Willi Christiansen, *Neue kritische Flora von Schleswig-Holstein*, 1953) repeat the treatment of Urban with nomenclatural alterations made by Burnat and Briquet, or (P. Fournier, *Les Quatre Flores de la France*, 1946) revert to an assortment of invalid and quite unjustifiable names. Hylander's Nomenklatorische und systematische Studien (1945) unfortunately mention only one species, *M. minima*, with an erroneous synonymy and a conclusion which I consider incorrect. What started as a seemingly minor routine task, checking the nomenclature of the species in my *Flora of North Central Texas* (which includes 6 of the 9 generally accepted as part of the North American flora), proved to be the most laborious and intricate bibliographic problem encountered in preparing the entire work.

*M. sativa* L., *M. falcata* L., and *M. lupulina* L. present no special difficulties. They are therefore not discussed here,

beyond mentioning that *M. lupulina* var. *glandulosa* Neilreich is in my opinion only a minor variation not worthy of varietal rank. The remaining species are a very different matter. The following annotated list gives the names and authorities correct under present rules of nomenclature, so far as I have been able to work them out. Synonymy is not complete, but is believed to include all names of importance in arriving at the accepted nomenclature, and those current in the United States.

M. ARABICA (L.) Hudson, Fl. Ang. 288. 1762. The same combination published later by Allioni, Fl. Pedem. **1:** 315. 1785.—*M. polymorpha* var. *arabica* L., Sp. Pl. **2:** 780. 1753.—*M. cordata* Desr. in Lam., Encycl. Meth. Bot. **3:** 636. Late 1791 or 1792. (Based on the preceding. Desrousseaux states that he does not believe it necessary to retain the Linnaean epithet for the plant "car elle est très-vraisemblablement aussi étrangère à l'Arabie que le *Vicia Benghalensis*, Lin., l'est au Bengale; que la *Scilla Peruviana*, Lin., l'est à l'Amerique; . . .") —*M. maculata* Sibth., Fl. Oxon. 232. 1794. The same name, with *M. polymorpha* var. *arabica* and *M. cordata* listed as synonyms, published later by Willdenow, Sp. Pl. (ed. 4) **3** pt. 2: 1412. 1802.

Early English writers treated *M. arabica* and *M. polymorpha* (*M. hispida, M. denticulata*) as one species, under the former name. Bartalini (Cat. Piante . . . di Siena, 1776) listed *Medicago polymorpha arabica* as "nomen triviale" under the diagnostic phrase-name given by Linnaeus for the species *polymorpha*—that is, he used *arabica* in the sense of var. *typica*, or var. *polymorpha*. Nearly all later authors have consistently understood *M. arabica* in the sense that it is today, as delimited in Urban's monograph. According to Urban (1883), the specimen in the Linnaean Herbarium under this name belongs to an entirely different species, "*M. ciliaris* Willd." (considered by Urban as a species newly described in 1802, because of doubt as to its identity with *M. polymorpha* var. *ciliaris* L.; the older *M. ciliaris* (L.) Krocker, 1790, was overlooked). The Linnaean citations are clear, agreeing with nearly all later usage, contradicting the specimen and the exceptional usage of Bartalini. There is no reason to depart from present usage in this case.

M. LACINIATA (L.) Miller, Gard. Dict. (ed. 8), *Medicago* 5. 1768. The same combination published later by Allioni, l. c. 316. 1785.—*M. polymorpha* var. *laciniata* L., l. c. 781. 1753. According to Urban, both the Linnaean specimen and the citations belong to Allioni's (Miller's) species.

M. MINIMA (L.) Bartalini, Catalogo delle Piante . . . alla Città di Siena, pp. 60–61. 1776. The same combination published later by Desrousseaux in Lam., l. c. 636. Late 1791 or 1792.—*M. polymorpha* var. *minima* L., l. c. 780. 1753. Urban states that there is no Linnaean specimen, but that citations indicate Bartalini's species; this is in accord with present usage.

As with *M. arabica*, some early post-Linnaean authors included *M. polymorpha* (*M. hispida*, *M. denticulata*) under this name. The combination is sometimes credited to Linnaeus's student, Grufberg (dissertation, *Flora Anglica*, 1754; Amoen. Acad. **4:** 105, 1759), or, in accordance with the early custom of crediting student publications to the supervising professor, to Linnaeus himself. Section Five of Grufberg's work is a list of species "secundum *Systema sexuale*." In Section One, Grufberg explained that to allow easy comparison of the floras of Sweden and England, names of species found in both countries are put in italics. The list is in two columns per page, with bare name only, "brevitatis caussa," and with numbers after each species referring to entries in Ray's *Synopsis Stirpium Britanniae*, edition 3. Four medicagos are listed by name, each on a different line, followed by three lines of dashes, for species (or varieties) without Linnaean names listed by Ray:

| | |
|---|---|
| Medicago falcata | 331-1. |
| lupulina | 331-2. |
| *polymor.* arab. | 331-1. |
| *minima* | 332-2. |
| . . . . . | 333-3. |
| . . . . . | 333-4. |
| . . . . . | 333-5. |

It is possible that the bare name *minima*, on a line by itself, was intended to stand for a species. It is just as possible that a minor error in printing, or failure to indent because of lack of space, was responsible for the implied new combination. The second and third editions of *Species Plantarum* continue to list *minima* as a variety. There does not seem to be con-

vincing evidence of an unequivocal new combination prior to Bartalini's. Hylander (1945) writes "*Medicago minima* L. (Grufberg) 1754 (non *M. minima* Bartalini 1776)." This is certainly an error, perhaps due to the fact that Bartalini's "N. Tr." (nomen triviale) occupies the first line on page 61, followed without break by the phrase-names of species no. 4, including that of Linnaeus's *M. polymorpha*. But Bartalini placed his binomials after the phrase-names, not before. Those phrases belonging with *M. minima*, species no. 3, are at the bottom of the preceding page, and include unequivocally a reference to *M. polymorpha* var. *minima* L., with page citation from the second edition of *Species Plantarum*.

According to Urban, *M. polymorpha* var. *hirsuta* L., Sp. Pl. 2: 780, 1753, is the same as *M. minima; M. hirsuta* (L.) Bartal., l. c. 61, is an additional synonym, published at the same time as *M. minima*. Also to be regarded as synonyms, representing minor forms, are var. *compacta* Neyraut (pathological; cf. Reynier, 1906 and 1908) and var. *longiseta* DC., recognized in Fernald's 8th edition of Gray's Manual. Urban accepted var. *longiseta*, short-spined var. *brachyodon* Reichenb., and spineless or nearly spineless var. *pulchella* Lowe, in addition to var. *vulgaris* Urban. Howell (1949) has reported var. *pubescens* Webb from California and var. *viscida* Koch from Arizona. These correspond to f. *pubescens* (Webb) Urban and f. *viscida* (W. Koch) Urban; f. *mollissima* (Roth) Urban is a third form described in the monograph. Unlike his style under *M. hispida*, and contrary to his statement that Greek letters indicated forms rather than varieties, Urban listed the three as if they were varieties, crediting them to Webb, Koch, and (Roth) Koch, respectively. All are listed together immediately following the description of the species; they are not put under var. *vulgaris* nor any of the three other varieties, which are all listed together after the three forms. On grounds of uniformity with other parts of the monograph, and because Greek letters preceded them, Urban's names for the three forms must be regarded as new combinations, though he failed to mark them as such.

M. ORBICULARIS (L.) Bartalini, Catalogo delle Piante . . . alla Città di Siena, p. 60. 1776. The same combination published later by Allioni, Fl. Pedem. **1:** 324–325. 1785.—*M.*

*polymorpha* var. *orbicularis* L., l. c. 779. 1753.—*M. orbiculata* Gaertn., De Fruct. et Semin. Pl. **2:** 349. 1791. (An evident error for *orbicularis.*)—Urban states that the Linnaean Herbarium contains under this name two specimens "of the usual form," with 3–4 compact spirals 13–15 mm. in diameter.

M. POLYMORPHA L., Sp. Pl. **2:** 779. 1753. This includes the plants commonly known as *M. hispida, M. denticulata,* and *M. apiculata* (detailed synonymy given below, under the varieties and forms).

Few Linnaean species have undergone such thorough disintegration as *Medicago polymorpha.* All the thirteen original named varieties were soon raised to specific rank by various authors, and by the early 19th Century, the name *polymorpha* itself went completely out of use. (Later references to, or combinations based on "*M. polymorpha* Willd." were errors for *M. polycarpa* Willd.) Under present rules, however, the name must be reinstated for some member of the original aggregate. Since it has not been in use for a century and a half, it has not become a permanent source of confusion and error. Unlike the names of the yellow-flowered species of *Trifolium,* it cannot be rejected on that account. Urban's account of the Linnaean species reports herbarium specimens of 10 of the 13 varieties, but none marked as *polymorpha* only. The name therefore cannot be typified by a specimen. Linnaeus's understanding of the components of his aggregate was very poor, as revealed in Urban's notes on the specimens and citations. The pre-Linnaean *Historia Plantarum* of Morison was much superior to Linnaean works in the treatment of bur clovers, and gives illustrations. Unfortunately, the Linnaean citations for *Medicago polymorpha* alone (not the varieties) were to publications which offer little help. The diagnostic phrase-name is "*Medicago* leguminibus cochleatis, stipulis dentatis, caule diffuso," quoted from *Hortus Cliffortianus* and *Hortus Upsaliensis,* and from Royen and Dalibardus. Next is quoted "Trifolium cochleatum, fructu nigro hispido," from Bauhin's *Pinax.* No illustrations are cited. Following this is the list of 13 named varieties, each with one or more phrase-names quoted from various authors, and for 7 of them, references to figures.

The fact that the first two phrase-names stand separate from

all the named varieties indicates that the type should not include any of the latter. The doctrine of residues leads to the same conclusion, since all the varieties were early recognized as species under their own names. The only possibly helpful item in the first name-phrase is "stipulis dentatis," though this description was applied rather loosely to stipules varying from toothed to rather deeply lobed. The quotation from Bauhin specifies a plant with prickly pods, black at maturity. It is to be assumed that the species *polymorpha* must be a fairly common and widespread plant, and one which was known to Linnaeus. The plant best qualified, as fitting the meagre description, widespread, known to Linnaeus in 1753, and not one of the varieties named at that time, is the later-described var. *nigra* L., which is nomenclaturally identical with *M. hispida* Gaertn. (since the phrase-name for *nigra* is quoted in the original description of the latter, though the epithet is not). According to Urban, Linnaeus had specimens of *M. hispida* var. *pentacycla* (a synonym of var. *hispida*) filed under his varieties *coronata, ciliaris*, and *nigra*. The species best known to Bauhin (judging from Binz & Thommen's *Flore de la Suisse*, p. 217, 1941) were *M. arabica*, *M. hispida*, and *M. minima*, of which only the second was not named as a variety by Linnaeus in 1753. (Although much is made here of the suggestiveness of Bauhin's phrase, it is not to be inferred that *Medicago polymorpha* can be positively typified merely on that basis; it is likely that Bauhin included more than one species under his phrase-name.)

Admittedly the above arguments are weak, but something has to be chosen. There are specimens only for some of the Linnaean varieties. The pre-Linnaean citations are inconclusive, and in any case should not be permitted to disturb later usage any more than can be helped. The few possible approaches to redefining *Medicago polymorpha* all point to the complex *M. hispida* Gaertner, as treated by Urban. (Gaertner's figure is, to me, unidentifiable, and suggests *M. ciliaris* more than *M. hispida;* Urban's interpretation, which did not include designation of a type element among the infraspecific taxa, is accepted because it included var. *nigra*, which is technically the basis of the species *hispida*.) The selection of *M. hispida* var. *pentacycla* (DC.) Urban as type element is made on the

grounds that this form was represented in Linnaeus's herbarium, even though misidentified by him under several varietal names. There is flimsy support from the fact that var. *nigra* repeats a key word from Bauhin's phrase-name, and is identical with var. *pentacycla*. *Medicago hispida* as delimited by Urban is still quite polymorphic (a total of 15 infraspecific taxa are named); it is a common and widespread species (though less so in Linnaeus's or Bauhin's time than now); a majority of its forms have spiny pods, black at full maturity; it was known to Linnaeus in 1753, though not well understood by him. Lastly, replacement of *M. hispida* by *M. polymorpha* involves no general displacement of names in the genus, and need not occasion any great confusion. *Medicago polymorpha* Linnaeus is therefore here typified by the element later named var. *nigra*, or *M. hispida* var. *pentacycla* f. *longeaculeata* of Urban's monograph, p. 75.

As with *M. arabica* and *M. minima*, early writers frequently included more than one species or variety (as now understood) under the same name. Fortunately, Urban clarified the Linnaean and many post-Linnaean names so that the purely bibliographic phase of revising his nomenclature is less formidable than it might have been. The biological interpretation of the taxa is far more difficult. No adequate account can be made without extensive investigations in the Old World, including intensive field work, and cultural and cytogenetic studies. Geographic evidence—so far as it can be gleaned from published floras—suggests that Urban's arrangement of infraspecific categories (disregarding named forms) is a reasonable one, and may justifiably be retained for the present. It should be mentioned here that on page 44 of his monograph, Urban states that single Latin letters indicate varieties, Greek letters, forms. The latter have been erroneously quoted by Burnat and Briquet as subvarieties.

Urban's primary groups (aa. *microcarpa* and bb. *macrocarpa*) are at the level of subspecies, but were given no designation of rank by him; they are designated subspecies in Christiansen's *Neue kritische Flora von Schleswig-Holstein* (1953, p. 313). To avoid nomenclatural complications, they are not transferred here (see discussion under var. *ciliaris*). Only the last two

varieties occur in the United States (one of these as yet only under cultivation). For completeness, the two strictly Old World varieties are also included, and essential synonymy given for all four. Following is a translation and partial revision of Urban's key (omitting forms), with order reversed because of modified typification. As additional characters under leads 1a-1b, Urban has "veinlets of legume anastomosing freely and well before reaching lateral nerves" vs. "veinlets of legume anastomosing only close to lateral nerves, or not at all." These statements contradict descriptions given by some European writers, and do not fit the specimens which have been examined; they are therefore omitted.

1a. Diameter of middle spirals of legume 7–10 mm.
  2a. Spirals 4–6 ..... var. *polymorpha*.
  2b. Spirals 1½–4 ..... var. *tricycla*.
1b. Diameter of middle spirals of legume 4–6 mm.
  3a. Spirals 5–6 ..... var. *polygyra*.
  3b. Spirals 1½–3½ ..... var. *ciliaris*.

M. POLYMORPHA var. POLYMORPHA. *M. polymorpha* L., Sp. Pl. **2:** 779. 1753. (Emended.)—*M. polymorpha* var. *nigra* L., Mant. Pl. **2:** 454. 1771.—*M. hispida* Gaertn., De Fruct. et Semin. Pl. **2:** 349. 1791. (Based on the preceding.)—*M. lappacea* Desr. in Lam., Encycl. Meth. Bot. **3:** 637–638. Late 1791 or 1792. (*M. polymorpha* var. *ciliaris*, *M. polymorpha* var. *nigra*, *M. hispida*, all cited as synonyms.)—*M. nigra* (L.) Willd., Sp. Pl. (ed. 4) **3** pt. 2: 1418–1419. 1802.—*M. denticulata* var. *lappacea* (Desr.) Benth., Cat. Pl. Ind. Pyr. p. 103. 1826.—*M. lappacea* var. *macracantha* (Webb & Berth.) Lowe, Man. Fl. Madeira p. 158. 1868. (Based on *M. denticulata* var. *macracantha* Webb & Berth., Phyt. Canar. **2:** 64. 1836–1840. This reference not seen. Lowe cites as synonyms *M. lappacea* Desr., *M. nigra* "(Willd.) DC.")

According to Urban the following also belong here. *M. pentacycla* DC., Cat. Hort. Monsp. p. 124. 1813. *M. lappacea* var. *pentacycla* (DC.) Gren. & Godr., Fl. Fr. **1:** 390. 1848.—*M. hispida* (bb. *macrocarpa*) var. *pentacycla* (DC.) Urban, Verh. Bot. Ver. Prov. Brandenb. **15:** 75. 1873.

M. POLYMORPHA var. **tricycla** (Gren. & Godr.[1]) Shinners, comb. nov. *M. lappacea* var. *tricycla* Gren. & Godr., Fl. Fr. **1:** 390. 1848. "Varie à courtes et à longues épines." The form

with long spines is taken as type.—*M. hispida* (bb. *macrocarpa*) var. *tricycla* (Gren. & Godr.) Urban, Ind. Hort. Bot. Berol. 1872 App. p. 3. (Not seen. Repeated in Verh. Bot. Ver. Prov. Brandenb. **15:** 75. 1873.)—*M. hispida* (aa. *macrocarpa*) var. *tricycla* f. *longispina* Urban, 11. cc. Including f. *microdon* (Ehrenb.) Urban, 11. cc., based on *M. microdon* Ehrenb., Cat. Sem. Hort. Berol. 1827 (not seen). Urban also lists "*M. obscura* var. *microdon* (Ehrenb.) Visiani" as synonym of this form, but Visiani (Fl. Dalm. **3:** 284, 1852) merely comments that Ehrenberg's plant "est varietas tuberculata M. obscurae," without making any formal transfer.

M. POLYMORPHA var. **polygyra** (Urban) Shinners, comb. nov. *M. hispida* (aa. *microcarpa*) var. *polygyra* Urban, Ind. Hort. Bot. Berol. 1872 App. p. 4 (not seen); Verh. Bot. Ver. Prov. Brandenb. **15:** 74. 1873. Two forms are named (*f. inermis* Urban, f. *aculeata* Urban); the first is taken as the typical form.—*M. reticulata* Benth., Cat. Pl. Ind. Pyr. p. 101. 1826.

Judging from published references, this is a fairly definite geographic variety of the western Mediterranean region, spineless or with very short spines. In recent years experimental plantings of it have been made in Texas, under the erroneous name *M. sardoa*, which is a synonym of the next variety. *M. polymorpha* var. *polygyra* has not so far been found as a wild plant.

M. POLYMORPHA var. **ciliaris** (Ser.) Shinners, comb. nov. *M. denticulata* var. *ciliaris* Ser. in DC., Prodr. **2:** 176. 1825. "M. ciliaris Savi cent. p. 148, non Willd." It is very unfortunate that Seringe did not supply a different epithet for this plant, so as to avoid confusion with *M. ciliaris* (L.) Krocker, based on *M. polymorpha* var. *ciliaris* L. As published, *M. denticulata* var. *ciliaris* must be treated as a new name, and is the first to be applied in varietal rank to the most widespread and commonly planted of the bur clovers. The identity of Savi's plant does not affect the application of Seringe's name, since the latter also gave a very brief description ("aculeis elongatis"), thereby validly publishing a new variety.

An awkward situation arises in connection with the nomenclature of this variety, due to conflict between Article 35 of the

[1] In a footnote under Leguminosae in the Flore de France it is stated "auctore Godron." The established custom of attributing new names to both authors is followed here, although very precisely only Godron should be mentioned.

International Code ("If any infraspecific taxon which includes the nomenclatural type of the epithet of the next higher taxon is to be mentioned by a subdivisional name, that name must repeat the epithet of the higher taxon unaltered") and paragraph 3 of Article 16 ("For any taxon below the rank of genus the correct name is the combination of the generic name with the earliest available legitimate epithet or epithets validly published with the same rank"). On grounds of priority, it is necessary to adopt the combination *M. polymorpha* var. *ciliaris*. But if subspecies are recognized, *M. hispida* ssp. *microcarpa* Urban (emend. W. Christiansen) must be transferred to *M. polymorpha*. Since it is identical as to type with var. *ciliaris*, and since var. *polygyra* would also be recognized under it, Article 35 would require the rejection of var. *ciliaris*, and adoption in its place of the new name, var. *microcarpa*, cited without author. The use of automatic epithets for typical varieties is a happy improvement when applied only to the type of a species. When extended to subspecies and varieties additional to the type, it becomes a very mixed blessing. I personally would retain Article 35 only for a hierarchy of epithets indicating the type of a species, but would reverse it with regard to other subspecies or varieties than the typical ones, on the grounds that only thus could changes of names be kept at a minimum. In the present case, for example, it would be more reasonable to say that var. *ciliaris*, being the oldest varietal epithet, must be retained; that as the earliest one, it should supply the subspecific epithet for any subsequent varieties associated with it. In other words, we would say ssp. *ciliaris* (no author) var. *ciliaris* (Ser.) Shinners, rather than ssp. *microcarpa* (new combination) var. *microcarpa* (no author). Whichever procedure is followed, one has the license, so to speak, to remove names at will, merely by creating a new one in another category. As Article 35 stands now, the number of changes which must be or could be made is appallingly large. It would be made much smaller by the reversed arrangement for non-typical subspecies here suggested, though not entirely eliminated. For the present, the whole problem is evaded by omitting subspecies entirely.

An additional synonym of *M. polymorpha* var. *ciliaris* is *M. hispida* (aa. *microcarpa*) var. *oligogyra* Urban, 11. cc. Urban

lists three forms, treated by many recent authors as varieties, and by some as species. They are assigned names here solely for purposes of discussion, and convenience in listing synonymy.

M. POLYMORPHA var. CILIARIS f. CILIARIS. Length of spines equalling or exceeding radius of spirals. This is the plant which passes in the United States as typical *M. hispida*, which it is in the sense of Urban, but not as to type. True *hispida* (*M. polymorpha* as here delimited) is not found either wild or commonly cultivated in this country. There is a long list of actual and *sensu* synonyms for f. *ciliaris;* only the following need be listed here. *M. denticulata* Willd., Sp. Pl. (ed. 4) **3** pt. **2:** 1414. 1802.—*M. denticulata* var. *vulgaris* Benth., Cat. Pl. Ind. Pyr. p. 103. 1826. (*Fide* Visiani.)—*M. hispida* (aa. *microcarpa*) var. *oligogyra* f. *denticulata* (Willd.) Urban, 11. cc.

M. POLYMORPHA var. CILIARIS f. **apiculata** (Willd., emend. Urban) Shinners, comb. nov. Spines shorter than radius of spirals. *M. apiculata* Willd., l. c. 1414. 1802. (As delimited by Urban, 11. cc.).—*M. hispida* (aa. *microcarpa*) var. *oligogyra* f. *apiculata* (Willd.) Urban, 11. cc.—*M. hispida* var. *apiculata* (Willd.) Burnat, Fl. Alpes Mar. **2:** 106. 1896.—*M. denticulata* var. *brevispina* Benth., Cat. Pl. Ind. Pyr. p. 103. 1826. (*Fide* Visiani.)—According to Grenier & Godron and others, the following belongs here. *M. sardoa* Moris, Stirp. Sard. Elench. p. 15, 1827 (*nomen nudum*); ex G. Don, Gen. Syst. Dichlam. Pl. **2:** 170. 1832. As mentioned before, plants in experimental cultivation as *M. sardoa* are *M. polymorpha* var. *polygyra*, or *M. reticulata* Benth.

M. POLYMORPHA var. CILIARIS f. **tuberculata** (Gren. & Godr.) Shinners, comb. nov. Spines absent; spirals smooth or merely tubercled. *M. polycarpa* var. *tuberculata* Gren. & Godr., Fl. Fr. **1:** 390. 1848.—*M. hispida* (aa. *microcarpa*) var. *oligogyra* f. *tuberculata* (Gren. & Godr.) Urban, 11. cc.—*M. apiculata* var. *confinis* W. Koch, Syn. Fl. Germ. Helv. p. 164. 1835.—*M. hispida* var. *confinis* (W. Koch) Burnat, Fl. Alpes Mar. **2:** 106. 1896.—The name *apiculata* has been applied to this form, and Willdenow's original description ("margine muricatis," "margine tuberculis admodum parvis spinescentibus obsita") suggests that he had this chiefly in mind. There is no sharp break between the three forms. Urban, who examined the

Willdenovian herbarium, was entitled to emphasize "spinescentibus" in delimiting the form as he did. It should be noted here that Grenier & Godron do not mention the earlier-named *M. tuberculata* Moris, Fl. Sard. **1:** 447, 1837. They do list as synonym of their var. *tuberculata* "*M. confinis Koch, olim,*" overlooking the fact that Koch had put his epithet into print, as a variety.

The three above forms intergrade completely. In the United States, selection of seed for agronomic purposes tends to fix a limited number of forms. Since escapes from cultivation are a major source of our wild plants, there is in reality an artificial selection, giving the impression that the forms are better marked or more permanent than is really the case. In eastern Texas, f. *ciliaris* is a common weed, while f. *tuberculata* is rare. The two intergrade freely when growing together, and this is said to be true of these two and var. *polygyra* when grown together under cultivation. Comments of some European authors (especially Lowe and Visiani) indicate that this is also true where the plants are native, and justifies Urban's treatment of the three so-called species as forms. Reasons for accepting var. *polygyra* in that rank (likewise Urban's treatment) have already been mentioned.

M. PRAECOX DC., Cat. Hort. Bot. Monsp., pp. 123–124. 1813. Reported by J. T. Howell as found in 1954 in Butte and Tehama counties, California (Leafl. West. Bot. **7:** 199, 1954).

Only those works giving helpful taxonomic, ecological, or geographical information are listed below. I am indebted to Mrs. Lazella Schwarten, Librarian, Harvard University Herbarium, for transcriptions of the original descriptions of *Medicago reticulata* Bentham and *M. sardoa* Moris.—SOUTHERN METHODIST UNIVERSITY, DALLAS, TEXAS.

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# THE VARIATIONS OF LILIUM CANADENSE LINNAEUS[1]

B. Boivin and W. J. Cody

In the New Britton and Brown Illustrated Flora **1:** 418. 1952, H. A. Gleason, apparently following the opinion expressed by E. D. Hull, Rhodora **44:** 220–7. 1942, has placed *Lilium michiganense* Farwell in the synonymy of *L. superbum* L. In Rhodora **44:** 453–6. 1942, Hull's opinion was carefully discussed and refuted by E. T. Wherry, who pointed out numerous differences between the two entities in pubescence of the leaves, dorsal ribbing of the tepals, length and curvature of the stamens, and extent of green zone at base of tepals. To these differences, M. L. Fernald, in Gray's Manual of Botany, 8th ed., 1950, p. 435, has added another character derived from the inflorescence. We agree with Wherry and Fernald that these two entities are distinct, but the degree of distinctiveness is not as sharp as Wherry would lead one to believe. While *L. michiganense* is normally minutely scabrous along the margin of leaves and on the back of the main veins, occasional smooth specimens, such as *L. H. Wright*, Yates Co., N. Y., do exist and papillose leaf-margins and veins occur in *L. superbum*. In the latter species the anthers are longer, narrower and curved, but they may be as short as 11 mm. as shown by specimens and described by Wherry. On the other hand the anthers of *L. michiganense* are generally shorter, thicker and straight, but may occasionally be curved or thin and, as described by Fernald, up to 17 mm. long. The dorsal ribbing of the perianth segments was quite clearly illustrated by Wherry, op. cit., p. 454, but an occasional specimen of *L. michiganense* will show the characteristic ribs of *L. superbum*. Unfortunately, the extent of the green zone at the base of the tepals cannot be checked on dried specimens, but this difference does not appear to be very sharp. It is described by Wherry, loc. cit., as follows: "In . . . *L. michiganense* this green area is mostly less than 10 mm. long . . . . In *L. superbum* it is 10 to 15 mm. long. . . ."

Heavily flowered specimens of *L. superbum* most often have the flowers in racemes; but umbellate, few-flowered and one-

[1] Contribution No. 1488, from the Botany and Plant Pathology Division, Science Service, Canada Department of Agriculture, Ottawa, Ontario.

flowered specimens which have the same type of inflorescence as *L. michiganense*, also occur. However, *L. michiganense* never presents the racemose type of inflorescence.

In none of the six characters discussed above are these two entities sharply distinct; and, as frequent intermediates occur, retention of these taxa at specific level does not seem to be warranted. The two populations, however, are fairly well marked and most specimens can be referred quite satisfactorily to one or the other taxon and retention at an infraspecific level seems amply justified on the basis of the characters described by Wherry.

*L. michiganense* is more closely related to *L. canadense* than to *L. superbum*. This was brought out by Wherry, op. cit., p. 435, who stated that "the intermediate *L. michiganense* surely does not 'belong to *L. superbum*,' lying instead close to *L. canadense*."

With the above statement we are in full agreement, although on general appearance alone *L. michiganense* could be readily confused with *L. superbum* because both entities have strongly recurved red-suffused tepals.

The degree of distinctiveness of *L. michiganense* and *L. canadense* was submitted to close scrutiny. Of the four usually recognized diagnostic characters, one, the flower color, could not be used with any degree of accuracy because, upon drying, flowers often become more reddish or lose all traces of red color. This change in color is evidenced by the discrepancies between field notes and the present color of the dried flower.

The three other characters are as follows:

| *L. canadense* | *L. michiganense* |
|---|---|
| 1—Tepals arched, not recurved; stamens and style usually included or nearly so. | 1—Tepals strongly recurved, their tips nearly reaching or surpassing the summit of the tube; stamens and style long exserted. |
| 2—Filaments straight or nearly so. | 2—Filaments outwardly arched, frequently incurved at tip. |
| 3—Stigma deeply lobed. | 3—Stigma merely emarginate, subglobose to shallowly lobed. |

Of the 75 odd sheets at hand, only 49 have fully developed flowers showing all characters listed above. Sorting the specimens for all three characters gives us the following results:

12 specimens are typical *L. canadense*
10 specimens are typical *L. michiganense*
27 specimens are intermediate

This is a very high ratio of intermediates, but 17 of these intermediates are intermediate for style only. If we contrast this number of 17 intermediates for style against the 10 and 12 specimens of each entity that are typical for all three characters, it is obvious that the lobation of the style has no diagnostic value whatsoever.

Re-sorting our specimens for the first two characters only gives us the following results and distributions:

17 specimens are typical *L. canadense:* 4 Nova Scotia, 2 New Brunswick, 7 Quebec, 1 New York, 2 Pennsylvania and 1 West Virginia.
22 specimens are typical *L. michiganense:* 14 Ontario, 1 Indiana, 1 Illinois, 3 Michigan, 1 Wisconsin, 1 Minnesota and 1 Kansas.
10 specimens are intermediate: 1 Nova Scotia, 1 New Brunswick, 2 Quebec, 4 Ontario, 1 Massachusetts and 1 Pennsylvania.

With only two diagnostic characters and such a high proportion of intermediates, retention of specific status for these two entities seems unjustified. Yet the two populations appear to be sufficiently distinct both morphologically and geographically to warrant retention at an infraspecific level.

We therefore consider that the recognized taxa of the *Lilium canadense* group should be brought together and subordinated as follows:

*Lilium canadense* L.
ssp. *canadense*
var. *canadense*
f. *canadense*
f. *rubrum* Britton
var. *editorum* Fern.
ssp. *michiganense* (Farwell) Boivin & Cody
*f. michiganense*
f. *uniflorum* (Farwell) Boivin & Cody
f. *peramoenum* (Farwell) Boivin & Cody
ssp. *superbum* (L.) Boivin & Cody

These taxa may be briefly characterized as follows:

Lilium canadense L. ssp. canadense. *L. canadense* L., Sp. Pl. **1:** 303. 1753; *L. penduliflorum* DC. ex Redouté, Les Liliacées **2:** 105. 1805 (non vidimus); *L. pendulum* Spae, Mém. Cour. Ac. Roy. Sc. Brux. Vol. 19, Essai d'une monographie du genre Lis, p. 28. 1847 (non vidi-

mus) nec *L. pendulum* Noronha 1790. Leaves usually scaberulous along the margin and along the nerves underneath; flowers solitary to umbellate (occasionally disposed in a group of umbels); tube with a green zone at base up to 10 mm. long; tepals recurved from near the middle, but not reflexed, yellow to orange, occasionally suffused with red, or completely red; midrib of petal more or less rounded on back; stamens and style included or only slightly exserted; filaments straight, rarely curved; anthers commonly oblong to lance-oblong, nearly always straight, usually less than 12 mm. long.

LILIUM CANADENSE L. var. CANADENSE. Median cauline leaves lanceolate to linear-lanceolate, usually more or less acuminate at tip; flowers commonly yellow to orange, often suffused with red, rarely deep red; petals usually broad.

LILIUM CANADENSE L. f. CANADENSE. *L. canadense flavum* Pursh, Fl. Am. Sept. **1:** 229. 1814; *L. canadense flavum* Hort. ex Waugh, Bot. Gaz. **27:** 356. 1899; *L. canadense* var. *flavum* (Hort. ex Waugh) Waugh ex Bailey, Cycl. Am. Hort. **2:** 922. 1900; *L. canadense* f. *flavum* (Hort. ex Waugh) Vict., Contr. Lab. Bot. Un. Montr. **14:** 15. 1929; *L. canadense* var. *luteum* Waugh ex Bailey, Cycl. Am. Hort. **2:** 922. 1900 (nomen alternativum). Flowers yellow to orange, occasionally suffused with red; petals commonly broad. Specimens examined from Nova Scotia, New Brunswick, southern Quebec, New York, Pennsylvania and West Virginia.

LILIUM CANADENSE L. f. RUBRUM Britton, Bull. Torr. Bot. Club **17:** 125. 1890; *L. canadense* var. *rubrum* (Britton) Waugh ex Bailey, Cycl. Am. Hort. **2:** 922. 1900; *L. canadense* β *coccineum* Pursh, Fl. Am. Sept. **1:** 229. 1814. Flowers red; petals up to 20 mm. across, usually about 15 mm. broad. Specimen examined from southern Quebec (Huntingdon Co.).

LILIUM CANADENSE L. var. EDITORUM Fernald, Rhodora **45:** 393. 1943; *L. canadense* ssp. *editorum* (Fernald) Wherry, Bartonia **24:** 7. 1947. Median cauline leaves elliptic or oblong to oblong-lanceolate, not acuminate at tip; flowers red; petals narrower, 8–13 mm. across, usually less strongly recurved than in the preceding variety. We have only two specimens at hand. This variety is reported to grow in mountains and upland dry woods from Pennsylvania and southern Indiana south to Alabama.

LILIUM CANADENSE L. ssp. **michiganense** (Farwell) stat. n., *L. michiganense* Farwell, Bull. Torr. Bot. Club **42:** 353. 1915; *L. michiganense* Farwell, var. *umbelliferum* Farwell, Bull. Torr. Bot. Club **42:** 353. 1915; *L. michiganense* Farwell f. *umbelliferum* (Farwell) Wherry, Bartonia **24:** 8. 1947. *L. pardalinum* Kellogg var. *Bourgaei* Baker, Journ. Linn. Soc. London, Bot. **14:** 242. 1875. Leaves usually scaberulous as in ssp. *canadense;* inflorescence also as in ssp. *canadense;* tepals strongly recurved from below the middle or from near the base, the tips nearly reaching or surpassing the base of the tube as in ssp. *superbum;* flowers orange, commonly reddish; color at base of the tube as in ssp. *canadense;*

midrib of the petal as in ssp. *canadense*, or rarely more or less sharply ridged as in ssp. *superbum;* stamens and pistil long-exserted, usually by about half their length; filaments usually outwardly curved, sometimes incurved again at tip, rarely straight or nearly so; anthers as in ssp. *canadense*. Specimens seen from southern Ontario, Indiana, Illinois, Michigan, Wisconsin, Minnesota and Kansas.

The most reliable distinguishing character between this and the preceding subspecies is the degree of curvature of the tepals. Of all the specimens at hand there is only one which is intermediate in this character: *Cameron* at Niagara Falls, Ont., July 1892. It is a single-flowered plant with spreading tepals as in ssp. *canadense*, but with filaments as in ssp. *michiganense*. As this specimen comes from an area where ssp. *canadense* is not known to occur we have referred it to ssp. *michiganense*.

For an interpretation of var. *Bourgaei* Baker, see Stoker, Roy. Hort. Soc. Lily Year-Book **4:** 26. 1935. The type of this variety was reputedly collected in Manitoba "ad ripas lacus Winnipeg" by Bourgeau, but we seriously doubt the accuracy of this geographical statement as no specimen of this very showy plant has ever turned up since or before from anywhere in Manitoba. Furthermore, Bourgeau's localities are notoriously incorrect.

Four phases of this subspecies have been recognized variously as species, subspecies, varieties or forms. These phases may represent no more than ecological forms or more vigorous or depauperate individuals, yet the vigor of some individuals may be susceptible of being segregated genetically. Since this subspecies is definitely of horticultural value, it seems desirable to recognize the two extreme forms as follows:

Lilium canadense L. ssp. michiganense f. **uniflorum** (Farwell) stat. n. *L. michiganense* Farwell var. *uniflorum* Farwell, Bull. Torr. Bot. Club **42:** 353–4. 1915; *L. michiganense* Farwell f. *uniflorum* (Farwell) Wherry, Bartonia **24:** 8. 1947. Plant usually smaller throughout; flower solitary, terminal. Throughout the range of the subspecies.

Lilium canadense L. ssp. michiganense f. **peramoenum** (Farwell) stat. n. *L. peramoenum* Farwell, Bull. Torr. Bot. Club **42:** 354. 1915; *L. michiganense* Farwell f. *peramoenum* (Farwell) Stoker, Roy. Hort. Soc. Lily Year-book **4:** 27. 1935. The whole plant more vigorous; leaves more numerous, eight to sixteen to a whorl; flowers large and very nuerous. Throughout the range of the subspecies.

The typical phase (forma *michiganense*), including var. *umbelliferum* Farwell, was originally described as having from 5 to 8 flowers. Yellow-flowered mutants have been reported by Wherry, Rhodora **44:** 454. 1942, but this phase has not been described and is not clearly represented among the material at hand.

LILIUM CANADENSE L. ssp. **superbum** (L.) stat. n. *L. superbum* L., Sp. Pl. ed. **2:** vol. **1:** 434. 1762. Leaves smooth or sometimes minutely papillose along the margin and the veins underneath; inflorescence umbellate to racemose; flowers orange-red; green zone at base of tube 10–15 mm. long; tepals strongly reflexed as in ssp. *michiganense;* petals sharply ridged on back along the midrib; stamens and pistil long-exserted; filaments recurved; anthers arcuate, linear, 11–25 mm. long.

This subspecies has been reported to range from Georgia and Alabama north to New Hampshire, New York and perhaps Indiana. This range should be extended to include Maine as we have at hand an excellent sheet of this subspecies (*H. N. Moldenke 18994*, Penobscot Co., South Lincoln, July 27, 1947).

Color mutants have been reported for this subspecies, but none has been named and none is represented among the material at hand.

In a recently published chromosome study, R. N. Stewart (The morphology of somatic chromosomes in *Lilium*, Am. Jour. Bot. **34:** 9–26. 1947) has, on the basis of their karyotypes, brought together within the same subgroup *L. superbum, L. philadelphicum, L. catesbaei, L. carolinianum* (= *L. michauxii*), *L. michiganense* and *L. canadense*. He remarks: "Five plants of *L. canadense*, two of *L. canadense* var. *rubrum* and two of *L. canadense* var. *flavum* all possessed identical karyotypes and all were indistinguishable from *L. michiganense*." The identity of the karyotypes confirms the opinion previously expressed by Wherry that these two taxa are very closely related indeed. Another taxon of the same subgroup, *L. superbum*, is also closely related to *L. canadense*. A fourth taxon, *L. michauxii* (= *L. carolinianum*), clearly belongs with the *L. canadense* group, but the lack of adequate herbarium material does not allow us to express a considered opinion as to its relative taxonomic status. It is, however, noteworthy that it was at one time reduced to varietal rank as *L. superbum* L. var. *carolinianum*

(Michx.) Chapman. The last two taxa, *L. philadelphicum* and *L. catesbaei*, have erect flowers, long-unguiculate tepals, etc. and are not particularly closely related to the *L. canadense* group.

A key to the major taxa described above has been published by E. T. Wherry, A Key to the Eastern North American Lilies, Bartonia **24:** 5–8. 1947.

The present study is based primarily on the specimens preserved in the Herbarium of the Botany and Plant Pathology Division, Science Service, Department of Agriculture, Ottawa (DAO), supplemented by those preserved in the Herbarium of the National Museum of Canada, Ottawa (CAN).

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## NUTTALL'S QUARREL WITH PURSH

Jeannette E. Graustein

Until 1936 there was no certainty about Thomas Nuttall's activities or location in 1812 and the years immediately following. Although we are now far better informed, little attention seems to be paid to the light which has been shed on this period. Thinking has not been brought into line with the facts that have been established.[1]

Of first importance in Nuttall's situation was his contract with Professor Benjamin Smith Barton, signed on April 7, 1810, before starting on his long expedition through the northwestern Territories. By the contract his journals and observations were the exclusive property of Barton who financed the journey; he was, however, permitted to retain a part of all the specimens which he collected but must not dispose of them without Barton's consent less "they might otherwise fall into the hands of persons who would use them to my disadvantage." "Should I ever publish the journal, I hereby promise and bind myself to make a public acknowledgement, that the journey was performed by you, and to give you full credit for what services you may have rendered to me."

When Nuttall arrived at New Orleans in December, 1811,

[1] F. W. Pennell, Travels and Scientific Collections of Thomas Nuttall," *Bartonia* **18** (1936), 1–51.

Jeannette E. Graustein, "Nuttall's Travels into the Old Northwest," *Chronica Botanica* **14** (1950/51), 1–88.

on his return from the upper Missouri, he found the COLUMBIA about ready to sail for Liverpool, the familiar ground of his apprenticeship and his home port which he had left almost four years before. Added to the natural desire of a young man (approaching his twenty-sixth birthday) to visit his family after so long a separation, was the serious threat of war between the United States and England which might postpone such a visit indefinitely. Before embarking for Liverpool he sent to Barton his share of dried plants and seeds with memoranda. There is evidence that in the notes he indicated his intention of naming the most flamboyant plant of his collection (which he believed belonged in an undescribed genus) in honor of Barton.

When Nuttall reached England early in 1812 he had no intention of publishing anything but *Bartonia;* not only was he legally restrained but he knew that to his patron any further publication would be an unforgivable sin. In 1810 Barton described Nuttall as distinguished by "innocence of character," and that was his reputation with the Astorians. He was so lacking in guile that his one treasured genus was snatched from him by the unscrupulous Pursh. That his quarrel with Pursh was strictly limited to the theft of the genus *Bartonia* has not been widely understood.

Nuttall met Pursh in London—doubtless at the Banksian Herbarium—and, since Barton had been the patron of both, eagerly showed him a specimen of the proposed *Bartonia* and the notes concerning it which he was planning to publish. Shortly thereafter, in August 1812, *Bartonia decapetala* appeared in the *Botanical Magazine* under Pursh's name although the accompanying colored plate was done from Nuttall's specimen. This was the grievance Nuttall held against Pursh—that he filched from him the only plant that he was free to publish from among the abundant and interesting specimens collected during two arduous and hazardous years. It was a cruel disappointment: it would have been Nuttall's first publication of any kind; it might have modified the disapproval of his somewhat estranged uncle whose support could facilitate his chosen work; it deprived him of the small unit of recognition in the botanical world for which he had hoped, leaving him with experience as his harvest from two years of labor.

Nuttall evidently drew a line between scientific botany and floriculture and between scientific collections and horticultural so far as his contract was concerned for he sold to Fraser seeds and living plants which he had laboriously transferred to England. He needed any funds they might bring. There is no doubt that he drew up the Fraser Catalogue.[2] It is equally certain that he did not consider it a valid publication of the species involved. That he intended to stand by his contract with Barton is indicated by the fact that he made no attempt to publish any of his new species in the *Botanical Magazine*—a device by which he could have anticipated a few items at least of Pursh's *Flora*—and remained aloof while others became authors of his plants in that publication.

When Pursh's *Flora Americae Septentrionalis* appeared in mid-December 1813, Nuttall was disturbed by the treatment of many of the species, especially the new plants of the West. He found the descriptions scant, habitats lacking, range erroneous, and in some cases he disagreed with the classifications. These deficiencies were to an appreciable extent the result of Pursh's limited field knowledge for he had not been south of Virginia nor west of the Appalachians. It became Nuttall's aim to write a new edition of Pursh's *Flora* in order to correct the errors. Although Shinners calls him "secretive" he announced this intention to William Baldwin in the autumn of 1815 not long after his return from England, and there can be no doubt that he told Zaccheus Collins and other friends of his plans. The outcome of this urgent wish was *Genera of North American Plants and a Catalogue of the Species to the Year 1817*, a work which grew from concern over the inadequacies of Pursh's *Flora* and which naturally, therefore, comments freely on Pursh's errors. This perhaps is the basis for Shinners' opinion that Nuttall "was resentful of Pursh's having anticipated him in publishing." Since Nuttall had known from the first that he could not publish the plants collected under Barton's aegis he had nothing personally at stake in the matter.—501 W. 113, NEW YORK CITY.

[2] No convincing evidence to the contrary has been furnished by Lloyd H. Shinners in questioning Nuttall's authorship in "Non-Validity of Nuttallian Names in Fraser's Catalogue." Rhodora 57: 290–293, 1955.

# VALIDITY OF NUTTALL'S NAMES IN FRASER'S CATALOGUE

Arthur Cronquist, David D. Keck and Bassett Maguire

Dr. Lloyd Shinners has maintained in a recent issue of Rhodora (**57:** 290–295. 1955) that the names usually attributed to Nuttall in Fraser's Catalogue, even those accompanied by descriptions, were not validly published. Fraser's Catalogue, an English nursery-firm's pamphlet that appeared in 1813, was published without formal indication of an author, but it is universally acknowledged that many or all of the new names contained in it were those of Thomas Nuttall. Many of these names were later republished by Nuttall with full descriptions, sometimes with a reference to Fraser's Catalogue, sometimes without.

Dr. Shinners shows that botanists have not been entirely consistent in their approach to Fraser's Catalogue, with the result that its rejection would displace some well known names, even while preserving others. *Penstemon grandiflorus* Nutt., which has regularly been accepted in floras and monographic work dating back at least to the fifth (1829) edition of Amos Eaton's Manual of Botany, would for example be replaced by the unfamiliar *P. bradburyi* Pursh if Fraser's Catalogue is banished to a nomenclatural limbo. We believe that the interests of nomenclatural stability would be better served by the admission of Fraser's Catalogue as a proper publication than by its rejection, but we do not rely on that argument to support our position.

Dr. Shinners argues that Nuttall was not himself the author of Fraser's Catalogue, and this may perhaps be true in a strictly literal sense, although it is obvious that the descriptions and comments accompanying some of the names must be Nuttall's own. Dr. Shinners further states that since the names were "anonymous as published," and "not avowedly accepted by any author," they are not validly published. Presumably he is relying here on Article 43 of the International Code of Botanical Nomenclature (Utrecht, 1952), which says that "A name (1) which is not accepted by the author who published it . . . is not validly published." This rule, however, as shown both by the examples and by the published discussion (Proc. 6th Int.

Bot. Congr. **1:** 364–366. 1936. Leiden) which preceded its original adoption, clearly pertains only to the intent of the author as expressed in the published work itself. If a name is formally and intentionally used, the pertinent part of Article 43 is complied with. It matters not that the author may change his mind, or never again use the name, so long as he has accepted it in the published work.

Dr. Shinners' contention that the names in Fraser's Catalogue were really anonymous, rather than being properly attributable to Nuttall, is immaterial. Anonymity of the author is no bar, under the Rules, to validity of publication of a name. Dr. Shinners suggests that his attempt to disqualify anonymous names in Fraser's Catalogue is merely an application of a principle propounded by Rousseau (Taxon **4:** 40–42. 1955) in the latter's attempt to dispose of the anonymous generic name *Americus*. We do not wish to comment on the status of *Americus* at this time, but we would point out that the question raised by Rousseau as to the serious intent of the author of *Americus* does not apply to the names used in Fraser's Catalogue.

Dr. Shinners points out that some of Nuttall's names published in Fraser's Catalogue were later taken up by him, while others were not. From this situation he concludes that "His inconsistent treatment gives us sufficient legal grounds, if anonymity be not enough, to disregard all names in the Catalogue." We disagree. The names in Fraser's Catalogue were accepted in that published work by whoever wrote it, and the subsequent action of Nuttall or any other possible author has no bearing on the validity of their publication.

Without at this time trying to determine what constitutes a "description" under Article 42 of the Rules, we believe that those new names which appeared in Fraser's Catalogue, accompanied by descriptions, are validly published.—THE NEW YORK BOTANICAL GARDEN.

PLATE 1222. *Ilex glabra* f. *leucocarpa*.

# ILEX GLABRA FORMA LEUCOCARPA: A WHITE-FRUITED HOLLY

Frank W. Woods[1]

In November 1954, a white-fruited specimen of *Ilex glabra* (L.) Gray was observed about 4 miles south of Marianna, Florida. The characterization of this hitherto undescribed color form of the species follows:

**Ilex glabra** (L.) Gray f. **leucocarpa** F. W. Woods, f. nov. A forma typica drupis albis, non nigris, differt. As in the typical form but with white rather than black drupes. Both the drupe and the persistent calyx are entirely devoid of pigment. Albinism also extends to the leaves, which are a distinctly lighter green color than immediately adjacent and normally pigmented specimens of *I. glabra*.

The specimen exhibits the typical growth form of *Ilex glabra*, being many-stemmed as a result of sprouting from rhizomes after being burned. Sprouts from rhizomes as far as 0.5 meter from the main clump also bear white fruits. There appears to be a single clone, covering an area of about 0.2 square meter.

A more detailed description of this new form follows: Leaf blade obovate, glabrous, lustrous, coriaceous, 1–2 cm. wide, 2–3.5 cm. long, margin remotely serrate at the distal end but otherwise entire; petiole 4–6 mm. long, round, glabrous. Fruit *white*, borne singly, 5–6 mm. long, 6–8 mm. wide; nutlets smooth; peduncle 4–6 mm. long; calyx glabrous, *white*. Twigs light green, angular toward the tip. A shrub 1.5 meters tall, similar to and growing in association with other specimens of dark-fruited *Ilex glabra*. Foliage is somewhat lighter than the neighboring specimens.

The habitat of *I. glabra* f. *leucocarpa* is identical to that of the typical form. Soil is moist and sandy. Principal associates are the typical form of *I. glabra*, *Baccharis*, *Rubus*, *Myrica*, *Pinus serotina*, and *P. palustris*.

Edge of woods about 4 miles south of Marianna, Jackson County, Florida, Jan. 20, 1955, *Frank W. Woods, C.E.F. 2*, holotype deposited in U. S. National Herbarium of U. S. National Museum, Washington, D. C. Isotypes have been presented to herbaria of U. S. Forest Service

[1] Stationed at East Gulfcoast Research Center, Marianna, Florida.

at Washington, D. C. and New Orleans, La., Gray Herbarium of Harvard University, New York Botanical Garden, Missouri Botanical Garden, Chicago Natural History Museum, University of Florida, Florida State University, University of Georgia, University of Tennessee, and University of Alabama.—SOUTHERN FOREST EXPERIMENT STATION, FOREST SERVICE, U. S. DEPT. OF AGRICULTURE.

---

VIABILITY OF SEED OF THE BLACK LOCUST.—In the early spring of 1930, on property now owned by Orland H. Soule, of Schoolcraft, Michigan, a mulberry hedge was set. In preparation for the planting a trench about eight inches deep was made. This brought to the surface some of the deeper soil. Later in the same season along a five-rod length of this planting 57 seedlings of black locust, *Robinia Pseudo-Acacia*, two and three inches high were counted at one time.[1]

I learned that locust trees that had been killed by borers were cut down in 1867 on property belonging to Dr. Nathan Thomas. The Thomas family kept diaries and I had first-hand the information about the time and the condition of the trees when cut. The trees had been on the east side of a four-rod street; the mulberry hedge, set in 1930, was directly opposite on the west side. I have been familiar with these two homes for the past 60 years and no trees of this species have been there during that period.

At the time the locust trees were removed wooden sidewalks were used and yards were enclosed by fences. The locust legumes naturally lodged against the fence and renewal of parts of sidewalk and posts for the fence placed some of the seeds where germination would cease. Locust seed is very hard and sprouts only under the most favorable conditions. Some years ago to get locust seedlings for future fenceposts the writer soaked the seed for several days. Each morning it was stirred in boiling water.

The mulberry hedge mentioned proved a nuisance and was cut in 1954. If it had been pulled out some of the deeper soil would have been brought to the surface and a favorable opportunity afforded to discover whether any seeds were still viable after another 25 years. The only remaining project

[1] HANES, CLARENCE R. AND FLORENCE N. Flora of Kalamazoo County, Michigan. 167: 1947.

was to exchange soil. Mrs. Hanes and I did this May 7, 1955. The top four inches of soil, between sidewalk and the roots of the mulberries, were taken out at two separate spots, each one by two feet in area. Then two bushels of the deeper soil were removed, one bushel of which was taken to our home and the other returned to the place from which it had been dug, only it was topside now. At our home we placed the soil in a plot two feet square and about four inches deep. The plot was well watered before and after the soil had been deposited.

We understood the chance for success in picking up soil with viable seeds was almost nil. Would the seed be present in the small amounts of soil under observation and if there were any, would they still be viable? We were pleasantly surprised for we have on July 12, 1955 in our home plot two vigorous locust seedlings, the one five inches, the other three inches high. The latest leaves of these have nine and seven leaflets respectively.

The home plot was well watered; the one along the hedge on the Soule's property had only the natural rainfall, which was scarce in early June but much more abundant later. At the time this paper was written, July 12, 1955. two small seedlings large enough, however, to show their identity had appeared.

The fact that four locust seedlings have grown in soil from the same location 25 years after the 57 that were discovered in 1930 appears to substantiate the conclusion that these seeds, dormant since the close of the Civil War, came from the trees cut in 1867. Some black locust seeds therefore stay viable for at least 88 years. We cannot say how long before 1867 the trees ceased to bear fruit.—Clarence R. Hanes, schoolcraft, michigan.

---

Silene virginica in the Gulf States.—The occurrence of *Silene virginica* L. in north Louisiana was first reported to me by Mr. Roy Morgan, a professional forester working in this area. In addition to his collection from Union Parish, I have collected it along the south side of D'Arbonne Bayou basin in northeast Lincoln Parish.

Hitchcock and Maguire[1] show the species as occurring in extreme northeast Arkansas only, and not in Louisiana or in

[1] Hitchcock, C. Leo and Bassett Maguire. A revision of the North American species of *Silene*. Univ. Washington Publ. Bot. **13**: 1–71. 1947.

the states immediately east of Louisiana. The only previous Louisiana reports are those of Riddell[2] and the statement of Miss Dormon "In rich soil from Georgia to Louisiana."[3] In a recent letter, Miss Dormon stated that she and her sister collected the species "in the vicinity of Shreveport."

The Union and Lincoln parish stations are about 150 airline miles from the nearest reported Arkansas collection. The col-

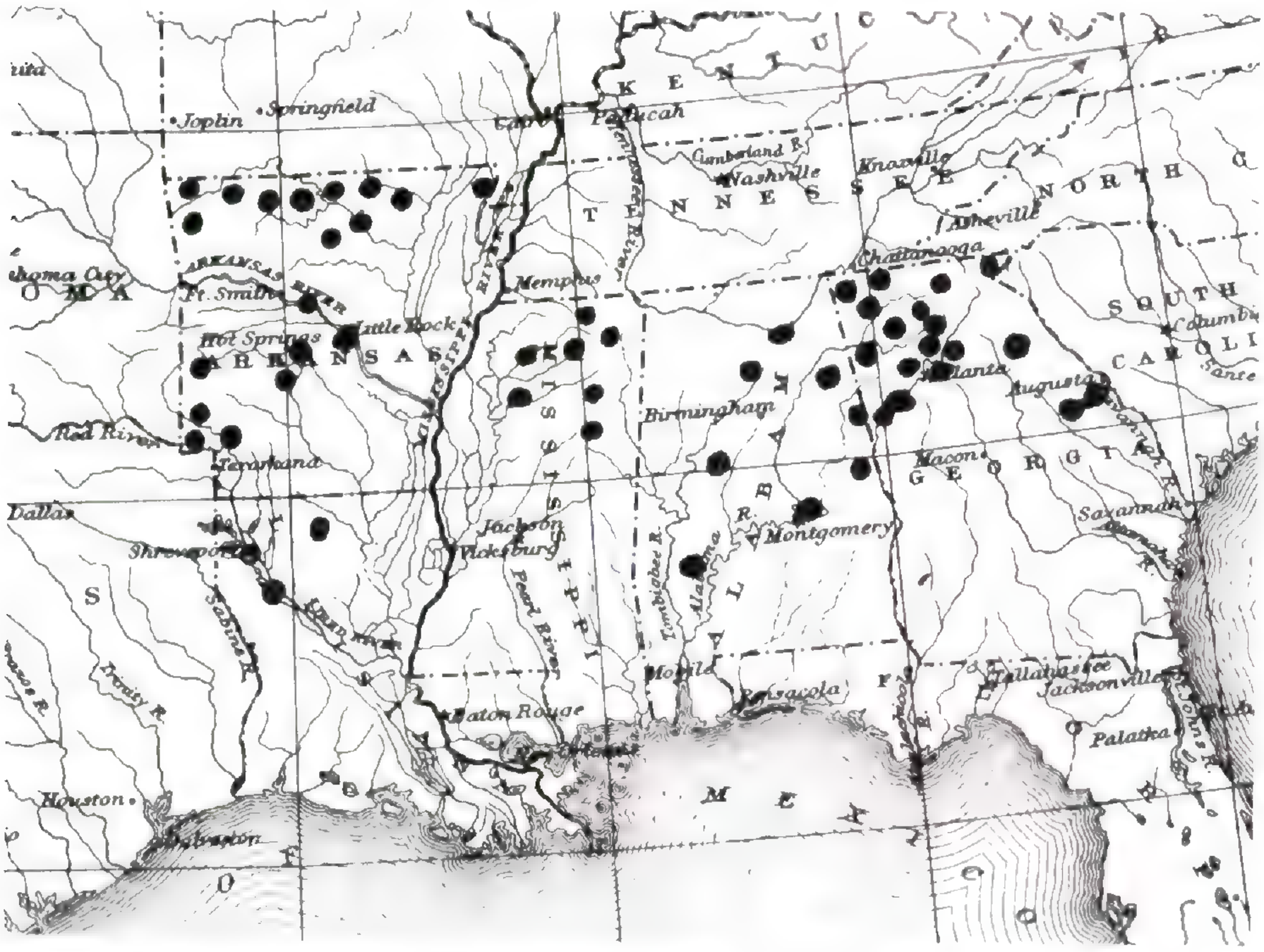


Fig. 1. Distribution of *Silene virginica* L. in the Gulf States.

lection from the Natchitoches area reported by Mr. George Ware of Northwestern State College (Fox, April 13, 1939) is about 135 miles south of the nearest known Arkansas collection, and about 70 miles from the Lincoln parish station. The report of Miss Dormon fills in some of the range gap that was previously apparent.

Further interest in the distribution of the species led to a request to southern botanists[4] for distribution data for the gulf states as shown by their herbaria. The accompanying map is based on the literature cited and on the information furnished by coöperating botanists.

[2] Riddell, J. L. Catalogus florae ludovicianae. New Orleans Med. & Surg. Journ. 8: 743–764. 1852.

[3] Dormon, Caroline. Wild Flowers of Louisiana. New York. 1934.

The county records reported to me are summarized together with their source as follows:

**Arkansas:** Benton, Carroll, Clay, Garland, Hempstead, Little River, Marion, Newton, Polk, Searcy, Washington (Iltis); Fulton, Hot Springs, Independence (Goodman); Sevier, Stone (Tharp); Pope (Shinners); Baxter (Schmitt). **Louisiana:** Lincoln, Union (Moore); Natchitoches (Ware); Caddo (Dormon). **Mississippi:** Lafayette, Lee (Schmitt); Okitbeha (Ray); Grenada, Kemper, Tippah, Union (Lowe).[5] **Alabama:** Lee, Marshall (Davis); Calhoun (Sharp); Randolph, Tuscaloosa (Shinners); Clark, Cullman, Montgomery (Mohr).[6] **Georgia:** Bartow, Burke, Clark, Cobb, Dade, DeKalb, Floyd, Forsythe, Fulton, Gwinnett, Heard, Lumpkin, Rabun, Walker, Whitfield (Duncan); Dawson (Shinners); Meriwether (Tharp).—JOHN ADAM MOORE, DEPARTMENT OF BOTANY, LOUISIANA POLYTECHNIC INSTITUTE, RUSTON, LOUISIANA.

[4] Botanists cooperating were: Donald E. Davis, Alabama Polytechnic Institute; Wilbur H. Duncan, The University of Georgia, Miss Caroline Dormon, Saline, La, George J. Goodman, University of Oklahoma, Hugh H. Iltis, University of Arkansas; James D. Ray, Jr., Mississippi State College; John A. Schmitt Jr., University of Mississippi; A. J. Sharp, University of Tennessee; Lloyd H. Shinners, Southern Methodist University; B. C. Tharp, University of Texas; George Ware, Northwestern State College.

[5] LOWE, E. N. Plants of Mississippi. Miss. Geol. Survey Bull. 17. 1921.

[6] MOHR, CHARLES. Plant life of Alabama. Contr. U. S. Nat. Herb. **6**. 1901.

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## NOTES ON TRIPHORA TRIANTHOPHORA IN ONTARIO


C. Harold Zavitz and Lulu O. Gaiser


Early in the summer of 1950, while the senior author was inspecting a woodlot in south-eastern Essex County, his attention was attracted by a small plant (approximately four inches tall) which was unlike any plant observed by him previously.

The plant had a fragile semi-transparent appearance and was of a light green or yellowish green color. Stem leaves were few in number, and small, being less than one-half inch in length, oval in outline, rounded to a triangular tip, and with a sheathing or clasping base. Subsequent visits were made to the area and other similar plants, about a dozen in number, were found in various parts of the woodlot. On August 21st the first flowers were observed and it was then recognized as a member of the ORCHIDACEAE.

By reference to "Gray's New Manual of Botany (Seventh Edition)", the plant was determined as *Pogonia trianthophora* (Sw.) BSP., although it was not recorded as from Ontario. Britton and Brown's Illustrated Flora further substantiated the original identification. This plant is given in "Gray's Manual of Botany (Eighth Edition)" and also in "Native Orchids of North America" by Correll as *Triphora trianthophora* (Sw.) Rydb. Neither of these authoritative works records it from Ontario, but Correll does say "from Canada (old record) through New England," etc.

The flowers arose from the axils of the leaves of the upper stem, the uppermost of the leaves being reduced in size so as to appear almost bract-like. The number of flowers on a plant varied from one to four.

The flowers resembled, in general form, those of *Pogonia ophioglossoides* (L.) Ker, but were much smaller in size being just over half an inch long. The color was milk-white to translucent. Under a low power lens, the papillose protuberances on the lip appeared almost crystalline. The crests of the lip showed a slight green coloration and a very slight suggestion of pink was observed on close inspections of some other portions.

On specimens examined, one or two tubers were attached to the end of the main root. These tubers were ovoid with the distal ends somewhat pointed and the proximal ends quite blunt. One plant obtained on August 21st was preserved. On September 12th, the same author again visited the area, and a specimen with a well-developed seed capsule was obtained. This specimen and the one obtained previously on August 21st are preserved in the author's herbarium.

In 1951, the area was inspected once, but no plants were observed. This peculiarity seems quite characteristic of this group of orchids, and may partially account for its lack of detection in an area so well populated. In 1952, I was in England and therefore unable to check the locality.

The next inspection of the area was on the 14th of August, 1953, when a specimen in flower was obtained. This was delivered in a fresh state that day to Dr. L. O. Gaiser who was summering at Crediton, Ontario, and she confirmed the original determination. The specimen was later verified by Mr. Charles Schweinfurth, of the Oakes Ames Orchid Herbarium and it has been placed in the Gray Herbarium, Harvard University. While obtaining this specimen a number of tubers were discovered which were not closely attached to foliaceous plants, but appeared to be evidence of the subterranean process of vegetative propagation which obtains in this and some related species. These tubers were usually in thick beds of hardwood leaves and humus, and somewhat remote from the mineral soil. Both authors visited the area in August, 1954, and saw at least twelve specimens in two neighbouring patches. Two inspections of the area in 1955 failed to reveal any plants.

The plants occurred in a sandy soil rich in humus, in medium to heavy shade of the native hardwood forest. The chief species of trees in the area in which this plant was found were

beech, hard maple, red oak, white elm, hickory and red ash. The Carolinian flora was represented there by tulip, chestnut, and sassafras, and in the general locality by flowering dogwood, sour gum, hop tree, papaw, and red mulberry.

Some authors class this orchid as a saprophyte. However, the amount of green in the plants observed would indicate that it is not entirely saprophytic and that under certain circumstances, at least, this species has the ability to develop chlorophyll and thus manufacture some of its own plant food.

The earliest reference to *Triphora trianthophora* (Sw.) Rydb. as having come from Canada, is in the Botanical Register (1825) t. 908. There, after the description of *Pogonia pendula*, John Lindley states; "Roots of this curious little plant were collected in Canada, by Mr. David Douglas, for the Horticultural Society, and flowered in an open border in the garden at Chiswick in August, 1824." A later paragraph includes the statement "Mr. Nuttall says it is parasitic round the roots of beech trees from New York to Kentucky, and that he has found it also in Canada."

W. J. Hooker, in Flora Boreali-Americana 11, p. 202 (1840), merely lists the plant referring to the above reference, but adds the name of Goldie to the two previously given after "Hab. Canada." Thus concerning the same plant, J. Macoun, in the Catalogue of Canadian Plants IV p. 11 (1888), writes: "Damp woods, Canada (Goldie fide Hooker)." He adds: "We have never seen a Canadian specimen of this species. It should be looked for in south-western Ontario."

While reports of this plant from Canada have been dropped from modern manuals, such as Gray's Manual (Seventh and Eighth Editions), Britton and Brown, and Gleason 1952, Correll (1950), referring to the "old record from Canada," gives credit to David Douglas for its introduction to England at Chiswick in 1824, as referred to by Lindley.

In the Journal kept by David Douglas during his travels in North America 1823–27, Wm. Wesley & Son, London (1914), his journey can be followed: On October 1 (1823) he crossed the Niagara River at Queenston, thus passing into the U. S. A., for "Lewiston on my way to Lockport." Then on page 17 begins the report: "Lockport, Friday, 3rd.—In company with

Mr. Thomas who kindly offered me the 'use of his person,' as he said, I visited woods north of Lockport which were almost all beech; we found two specimens of *Corallorrhiza*—one like *innata* of Britain, the other a small one. I secured plants of them"; continuing on page 18 we find: "the soil was dead leaves, very dry. Along with them grew *Triphora*,[1] also a *Cypripedium* in partly shaded parts, soil dry sandy peat; *Viola* sp. leaves round, large, flowers small white striated."

There is an appendix "Plants introduced by David Douglas during the years 1826–34" and on p. 334 is listed "*Pogonia pendula*, Lindl. in Bot. Reg. *t* 908-North America."

With these as the only references to *Pogonia* or *Triphora*, it would seem that if the belief that the species was collected in Canada is based on Douglas' collection, it is ill-founded.

A search has since been made for specimens or a report of a collection of this plant in Canada that would confirm the "old record." Negative reports to inquiries for Canadian specimens have come from the curators of the following herbaria: National Museum and Dominion Experimental Farm in Ottawa, Botanical Garden in Montreal, the Universities in Toronto, Kingston, London, Hamilton and the Agricultural College at Guelph, Ontario. There is also no former specimen from Canada in the Gray Herbarium.

When the inquiry was sent to the first of these herbaria, Mr. A. E. Porsild kindly offered to look for specimens of *Triphora trianthophora* at Kew and the British Museum when he visited those herbaria during the year 1954–55. We are deeply indebted to him for his help.

He has reported the following: At Kew, under the above name are seven sheets, each with 1–3 separate collections. One sheet, stamped "Herbarium Hookeranium 1867," contains three collections, two of which are labelled *T. pendula* with given localities in the U. S. A. and a third labelled "*Arethusa pendula*," written on the original ticket, and in another hand, "Canada Gouldie." On a second sheet are collections labelled *T. pendula* likewise "Herb. Hook. 1867," each bearing a collector's name but no other data. That in the lower right corner, in Hooker's hand, bears the name "Douglas." The rest are all specimens from the U. S. A.

"[1] *Pogonia* Benth & Hook"

Mr. Porsild concluded, "Thus at Kew there is only one specimen definitely labelled Canada. Possibly 'Gouldie' is meant for 'Goldie'."

He further reported that no Canadian specimen could be found at the British Museum.

While there is neither evidence on the sheet bearing the Douglas specimen nor any record in his own Journal that he collected this plant in Canada, both Hooker's Herbarium and his Flora confirm Goldie's collection of it here.

---

## FROELICHIA GRACILIS IN MARYLAND

S. F. Blake

*Froelichia gracilis* (Hook.) Moq., of the family Amaranthaceae, is regarded as indigenous in the region west of the Mississippi River from Nebraska or Iowa to Colorado, south to Texas, Arizona and Chihuahua. Its extension of range eastward in recent years even to several of the coastal states indicates the possession of a roving disposition which might complicate the problem of determining precisely its original native habitat. Standley, in 1916, did not know it east of the Mississippi, for he assigned a range from Iowa to Colorado, southward to Arkansas, Arizona, and Chihuahua (North Amer. Flora **21:** 127). The seventh edition of Gray's Manual (1908) and both editions of Britton and Brown's Illustrated Flora (the second in 1913) had given a similar but more restricted range. In the 8th edition of Gray's Manual (1950) Fernald assigned essentially the same range as Standley had done, but added: "Adventive eastward to New York, New Jersey, and Virginia."

The first report from east of the Mississippi appears to have been that of H. D. House in 1924 (N. Y. State Mus. Bull. **254:** 303) recording it from railroad tracks at Despatch, Monroe County, New York, 1920, where it was found by D. M. White. Apparently the species has been collected only once again in New York, on waste land near railroad tracks at Cold Spring, Philipstown, Putnam Co., 22 Aug. 1953, by K. L. Brooks, S. J. Smith, and J. J. Wurdack. In 1929 H. C. Benke (Rhodora **31:** 146) reported it from Cairo, Illinois, where he had collected it in 1928. C. C. Deam in 1940 (Fl. Indiana 431. map 887)

listed it from four counties in Indiana but indicated its presence in five on his map. He had first found it in 1930 along a railroad about four miles south of Vincennes, in almost pure sand, and three years later found that it had spread a quarter of a mile along the track. He predicted that it would "probably become a weed in the sandy area of this part of the country" (very likely referring to the sandy region around Lake Michigan in Indiana and Illinois), but there are only four additional counties recorded in the 14 annual supplements to his Flora of Indiana that have been published to date.

The eastward spread of the species has taken place almost entirely along railroad tracks. Of 24 specimens in the herbarium of the University of Illinois coming from 19 different counties in all parts of that state, the data for which have kindly been supplied by Dr. G. Neville Jones, 20 were collected along railroads, 2 by roadsides, and for 2 the habitat was not specified, as is the case also with Benke's original collection in the Chicago Natural History Museum herbarium. Of 16 specimens from other states, cited below, all but the 2 from New Jersey were found along railroads; the New Jersey specimens were collected along a path and in sandy fields, respectively. All four of the Indiana localities given in Deam's Flora were along railroads.

The occurrences of this species in the eastern states as represented by specimens in the Gray Herbarium (GH), Department of Botany of the University of Illinois (ILL), New York Botanical Garden (NY), New York State Museum (NYS), Ohio State University (OS), Philadelphia Academy of Natural Sciences (PH), and United States National Herbarium (US) are summarized here. Dr. R. C. Rollins (GH), Dr. G. N. Jones (ILL), Dr. Arthur Cronquist (NY), Stanley J. Smith (NYS), Miss Clara Weishaupt (OS), and Dr. C. Earle Smith (PH) have kindly supplied the data for their respective institutions. Individual collections have been cited from only a single herbarium, but some of them are also represented in other institutions.

New York: Monroe Co., 1920 (GH); Putnam Co., 1953 (NYS). New Jersey: Camden Co. 1944 (PH), 1946 (GH). Pennsylvania: Berks Co., 1945 (PH); Delaware Co., 1942 (GH); Lackawanna Co., 1926 (PH); Montgomery Co., 1944 (PH); Northampton Co., 1946 (PH); Schuylkill Co., 1944 (GH). Virginia: Dinwiddie Co., 1939 (GH); Henrico Co., 1940

(GH); Sussex Co., 1939 (GH). OHIO: Scioto Co., 1951 (OS). INDIANA: Knox Co., 1941 (NY); La Porte Co., 1942 (NY); reported from 7 other counties. ILLINOIS: First record, 1928, Alexander Co; represented (ILL) by specimens from this and 18 other counties in all sections of the state.—Not reported from West Virginia or Kentucky.

On 29 Sept. 1954 and again a week later I had occasion to investigate an infestation of this plant on the farm of J. Thomas Simpson in Odenton, Anne Arundel County, Maryland, which apparently provides the first record for the species in that state. Thousands of specimens were growing in sandy soil on the edge of a cornfield and among the low weeds (*Diodia*, *Digitaria sanguinalis*, etc.) on the uncultivated border of the field, mostly in an area about 150 by 50 feet, in places very thickly, in others sparsely, and there were scattered plants in other parts of the field and in an adjoining pasture. Mrs. Simpson informed me that the plant had first appeared there about 5 or 6 years ago, but had not become abundant until 1953. Their cattle will not eat it. The specimens growing in loose open sand were very well developed, up to about 60 cm. high with several assurgent basal branches as long as or longer than the stem; those growing among dense weeds were mostly simple and shorter.

The nearest railroad to Mr. Simpson's place is a spur track of the Pennsylvania RR. about a mile away, running in to the Bowie Race Track (in Bowie, Prince Georges County) and used in season for the transport of horses and their fodder and bedding. Because of the plant's close association with railroads, it seemed reasonable to suspect that this might have been the source of introduction to Mr. Simpson's farm, particularly since his daughter, Miss Marion E. Simpson, informed me that her father had occasionally brought in straw from the race track. On 25 July 1955, when I visited the spot in company with Miss Simpson and Paul G. Russell, several score specimens were found on the railroad tracks between the stables and the Administration Building, where the horses and their supplies are unloaded.

The weedy nature of the plant is emphasized by my own experience with it. I collected a number of specimens on my first visit to the farm, and must have unintentionally picked up a number of fruits on my person as well, for the next morning, in my home in Virginia, I found in my bed a number of rough

little objects which felt like small pebbles but turned out to be the fruiting calyces of this plant. They must have been carried home attached to my stockings or trousers or in my shoes, but I am puzzled to explain their transfer to the bed. They are unpleasant to walk on barefooted, but not nearly as much so as the fruits of *Tribulus* or *Cenchrus*. However interesting the plant may be as an addition to the flora of Maryland, that state has no need of any more weeds, and Mr. Simpson is attempting to eradicate it by cultural treatment before it spreads further. The railroad tracks at Bowie are sprayed regularly each summer, but it is very improbable that this procedure would have much effect on the multitude of seeds that must have been scattered previously from the plants growing there.—PLANT INDUSTRY STATION, BELTSVILLE, MD.

## SHORTIA GALACIFOLIA IN GRAY'S MANUAL RANGE[1]

Dorothy L. Crandall

*Shortia galacifolia* has been called by C. S. Sargent (1888) "one of the rarest and most interesting plants of North America" and since the first pressed specimen of *Shortia* was rediscovered by Asa Gray among Michaux's unknowns, search for this species has intrigued many botanists.

In a recent article in Rhodora, P. A. Davies (1955) lists seven counties in which *Shortia* has been found, one in Georgia, two in South Carolina, and four in North Carolina. No natural colonies have been reported from outside this rather restricted area and yet ecologically there are many similar habitats in other mountainous sections of the Southeast. Aware of its limited distribution, the author was somewhat surprised to discover a flourishing colony of *Shortia* along a creek in Amherst County, near Lynchburg, Virginia.

On the relatively steep east-facing bank (altitude approximately 650 feet) of this small creek, just a few feet above the water, was a patch of *Shortia* covering an area about three by six feet. On this date, April 9, 1955, only a few scattered blossoms were evident, varying from white to pale pink. Most

[1] Contribution from the Botanical Laboratory, The University of Tennessee, N. Ser. No. 169.

of the earlier flowers had withered without forming fruit. Photographs were taken and specimens were collected. The latter are being deposited at the Gray Herbarium, the U. S. National Herbarium, and the herbaria of The University of Tennessee and Randolph-Macon Woman's College.

Downstream a few feet away from the original group, a small clump of three plants was growing. A search upstream disclosed three more plants about twenty feet away and another small group about four feet away. The stream was traced to its source, only a few hundred feet, but no more plants were seen.

The author made two subsequent trips to the site, one in the company of Franklin Flint of Randolph-Macon Woman's College and the other with Mr. Flint and Ruskin Freer of Lynchburg College. About 300 feet downstream at a point just above where this creek joins a still larger creek that flows into the James River about a half mile away, another clump of *Shortia* approximately two by three feet was located on a knoll overhanging the creek. A search for several miles up the larger creek failed to disclose any additional stations.

The first colony appeared to be well established and had spread both by stolons and by seeds. On bare and mossy soil and only seen when the overhanging leaves of *Shortia* were lifted, were dozens of seedlings of various sizes. In addition to these a few seedlings were observed several feet away from the parent plants, the seeds having washed down the steep bank. Bailey's Standard Cyclopedia of Horticulture (1933) states "It is difficult to procure seed as the flowering stem usually withers away before maturing, though shortia is readily propagated by division and runners." C. F. Jenkins (Arnoldia, 1947) adds "Apparently no plants were propagated in this way," referring to attempted propagation by seeds. On a visit to the area near the end of May a few flowers, perhaps a dozen or so in all, had formed capsules.

The conspicuous canopy trees included *Nyssa sylvatica*, *Fagus grandifolia* and *Liriodendron Tulipifera*. In the understory were *Cornus florida*, *Hydrangea arborescens*, *Alnus serrulata* and *Kalmia latifolia*. Intermingled with the colony were *Polystichum acrostichoides*, *Dryopteris noveboracensis* and *Athyrium*

*Filix-femina*. Important among the low flowering herbs were *Asarum virginicum*, *Iris cristata* and *Medeola virginiana*. *Galax aphylla* was abundant, the bank of the stream lower down carpeted with blankets of it.

A search of the area disclosed no old gardens from which *Shortia* could have escaped and local inquiries have yielded nothing as to the origin of these plants. The creek is part of a small farm which has changed hands many times and until the present owner purchased the land about ten years ago, no one had taken any interest in improving the property. Any information as to the possible introduction of these plants would be appreciated.

However this species may have first gained its foothold on this creek bank in Virginia, it is of interest that *Shortia* is flourishing and spreading both by seeds and stolons in an area within the range of Gray's Manual and considerably north of its previously known distribution in the Carolina mountains.—RANDOLPH-MACON WOMAN'S COLLEGE, LYNCHBURG, VIRGINIA.

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# NOTES ON UTRICULARIA BIFLORA AND U. FIBROSA

Leonard J. Uttal

The Bladderwort, *Utricularia biflora* Lam., grows in certain wet places in Coastal Plain pine barrens, from southeastern Massachusetts to Florida, Texas, and Oklahoma. Rare and local in the north, it nevertheless seems odd that but one station, herewith reported for the first time, seems to be known for this species in New Jersey, where likely habitats are so frequent.

This station is on the Public Hunting and Fishing Grounds, at Archer Corner, Ocean County, New Jersey, where the writer collected plants in August, 1954. Less than a half-meter square, the colony grew in water just a few centimeters deep, the submersed parts enmeshed in muck, amidst remnant cranberry and sphagnum of a receding bog, well invaded by upland flora, perhaps as a result of fishing management operations on the preserve. A colored photograph was made of the colony, later affixed to the voucher of this collection, deposited in the herbarium of the New York Botanical Garden. A second collection was made in June, 1955, the specimens gathered and prepared with special care so that the trichotomous leaves, nearly all bladder-bearing, and the delicate, slender habit typical of this species are well exhibited. This collection is deposited in the same folder with the first one.

*U. biflora* was first reported from New Jersey by Taylor (1915). Taylor cited the locality as "Georgetown, Sussex County, New Jersey." Sussex County is largely Alleghenian upland, and unlikely to offer acceptable habitat for *U. biflora*. Furthermore, there is no "Georgetown" in Sussex County. Mr. Joseph Monachino, of the New York Botanical Garden Herbarium, wrote me that there was a specimen there (which I later examined), collected by N. L. Britton (No. 23), bearing, in Britton's handwriting, the legend: "edge of pond near Georgetown," with a printed label: "Plants from Sussex County, Delaware, July 5, 6, 1908." There is, of course, a Georgetown, Sussex County, Delaware, and Taylor probably based his report on this specimen. Subsequent Floras carried on this misconception.

Closely related to *U. biflora*, and with a remarkably similar

range, is *U. fibrosa* Walt. It is a larger and coarser plant than *U. biflora*, with usually more complexly developed leaf structure. Current manuals all state that *U. fibrosa* has two types of leaves: the usual, bladder-bearing leaves, associated with the scape, and specialized, purely vegetative leaves, not bearing bladders, on certain more remote branches, crowded on the branch, finely dissected, forming a plumose, natant organ. *U. biflora* suffices with the bladder-bearing leaves; it developes no specialized vegetative branches.

In perusing considerable herbarium material of both species, the writer felt uneasy about the character of specialized vegetative branches assigned to *U. fibrosa*. Some specimens clearly exhibited these natant organs; others had either lost them, or perhaps never had them. Unless carefully prepared, dried Bladderworts can be notoriously difficult to identify, and this might account for some of my difficulty. Yet there are other reasons for questioning the constancy of vegetative leaves in *U. fibrosa*. As Gleason (1952) points out, both *U. biflora* and *U. fibrosa* may become stranded, in which case, vegetative leaves may not be detected in the latter. There is evidence to indicate that *U. fibrosa* may prefer deeper water than *U. biflora*. This I observed in New Jersey. Collectors of *U. biflora* make more frequent reference to especially shallow sites than do collectors of *U. fibrosa*, judging from herbarium sheet notations.

The plumose, natant, vegetative branches of *U. fibrosa* are analagous to the finely dissected leaves of *Ceratophyllum* or similar aquatics in function. It has already been demonstrated that when this species becomes stranded, these organs evanesce. It would be a notable experiment to observe what might happen if a stranded *U. fibrosa* were reset in deeper water—would plumose leaves reappear? Is there a possibility that if *U. biflora* were reset in deeper water, it would develop vegetative branches? In other words: vegetative branches are not always present as a key character of *U. fibrosa*—are they really inherently specific, or are they a physiological response to environment?

Extensive field studies, experiments, and cytotaxonomic investigation are needed for a true, intrinsic concept of Bladderwort taxonomy. These fascinating aquatics offer a nicely concise problem for taxonomic research, and a grand oppor-

tunity for a student to make a major contribution to botanical knowledge.

In the absence of well-exhibited leaf characters, *U. biflora* may generally be distinguished from *U. fibrosa* by dimensions. *U. biflora* is delicate, with a filiform scape, less than a millimeter in diameter, and from five to fifteen centimeters long from the top submersed branch to the lowest peduncle. *U. fibrosa* is much coarser, with a scape 1 to 2 millimeters in diameter, and from ten to twenty or more centimeters in length.

To Mr. Joseph Monachino, of the New York Botanical Garden Herbarium, I extend my sincerest appreciation for much that is basic to this paper.—1258 BEACH ROAD, RIVIERA BEACH, FLORIDA.

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# YONKERS WOOL MILL PLANT RECORDS

JOSEPH MONACHINO

FOR years to come Fernald's 8th Edition Gray's Manual of Botany and Gleason's The New Britton and Brown Illustrated Flora will offer ready means of comparing divergent views on the plants of the northeastern United States and adjacent Canada. The Manual, in general, has a more inclusive approach and admits more taxa, particularly of the minor kind, than the New Britton and Brown. Some adventive or introduced species, like *Setaria Faberii* Herrm., *Cynosurus echinatus* L., *Polygonum perfoliatum* L., and *Phellodendron japonicum* Maxim., appear in the former but not in the latter work. There are, however, several noteworthy instances where the situation is reversed. *Scirpus mucronatus* L. and *Scirpus Tabernaemontani* Gmel. are two examples. Incidentally, both of these were collected on ballast at Camden, New Jersey, and probably both were from the Isaac C. Martindale herbarium dated 1877 or about that time; yet the New Britton and Brown accords

one full standard treatment, while relegating the other to a footnote under *S. acutus* Muhl. A. A. Beetle in 1941 annotated the Martindale specimen as *S. lacustris* L. var. *Tabernaemontani* (Gmel.) Doll. *S. lacustris* is mentioned by Gleason in a footnote under *S. validus* Vahl., whereas it is disregarded by Fernald.

Waifs collected in the vicinity of the Yonkers Wool Mill, New York, at the close of the 19th Century offered a number of species for the New Britton and Brown: *Pennisetum ciliare* (L.) Link., *Andropogon Ischaemum* L., *Cenchrus barbatus* Schum., *Chloris ciliata* Sw., *Aegilops crassa* Boiss., *Scirpus Holoschoenus* L., *Veronica campylopoda* Bois. The last species is merely noted in the discussion under its genus, while the others are systematically described and illustrated. However, the collection records for all are about the same, as far as the eastern range is concerned. *V. campylopoda*, often merged with *V. biloba* L., has become widespread in northwestern United States (Utah, Idaho, Montana, Washington). These old records are ignored by Fernald, it would seem deliberately so, since most of them had been published (Torreya **37:** 15. 1937; Rhodora **23:** 21. 1921).

There are six additional species, collected by E. P. Bicknell (without collection numbers) in Yonkers from 1890 to 1898, which (with the exception of *Herniaria cinerea*) do not appear in any of the floras of our area. The specimens were recently discovered and identified by the writer at the New York Botanical Garden, where they had long reposed amongst unnamed material.

Herniaria cinerea DC. About the Yonkers Wool Mill, July 8, 1894 and July 20, 1898. Flowers in the specimen examined have only two stamens. The species is but little different from *H. hirsuta* L. Native to Europe, North Africa and the Near East.

Polycnemum arvense L. Collector not designated (probably E. P. Bicknell), Yonkers Moquette Mill, July 29, 1890. *P. majus* A. Br. has been reported from Ontario. The bracts in the Yonkers specimen are shorter than the sepals, a character which distinguishes *P. arvense*. Native to Europe and the Near East.

Gypsophila porrigens (L.) Boiss. About the Yonkers Wool Mill, September 17, 1898. Our specimen is comparatively small, with shorter leaves and shorter pedicels than usual. Native to the Near East and introduced in Europe.

Helianthemum salicifolium (L.) Mill. About the Yonkers Wool Mill, July 8, 1894. Native to Europe, North Africa and the Near East.

ANDROSACE MAXIMA L. About the Yonkers Wool Mill, July 8, 1894. A fruiting specimen; seeds approximately 2 mm. long; calyx-lobes entire. Native to Europe, North Africa and the Near East.

LIMONIUM LEPTOSTACHYUM (Boiss.) Kuntze. About the Yonkers Wool Mill, June 26, 1898. Described by Boissier in DC. Prod. **12:** 669 (1848). There is an excellent photograph of the multispicate form of the species in Acta Horti Petropolitani **35:** t. 2 (1921). Native to Persia and the adjacent country north (Bukhara, Samarkand).

Another two species are represented by Bicknell specimens inadequate for determination, but may be the following: *Panderia pilosa* Fisch. & Mey. About the Yonkers Moquette Mill, September 1, 1894; flowers too young. Yonkers Cotton Mill, July 1, 1894; sterile. Closely related species have been proposed. Our sterile specimen has the hairs spreading as described for *P. turkestanica* Iljin (*P. pilosa* Auct. Turkest. non F. et M.). Native to the Near East. *Convolvulus pilosellaefolius* Desr. About the Yonkers Wool Mill, July 8, 1894; flowers too young. Native to the Near East.

The species from Yonkers listed above hardly can be considered actual members of our eastern flora. Whatever interest they may have is chiefly historical. What are the chances of *Limonium leptostachyum* ever appearing in the United States again? For that matter, what are the chances of *Thismia americana* N. E. Pfeiff. again being found in the vicinity of Chicago! It is not always easy to decide what elements to include in a manual primarily designed for the identification of the plants of an area.—NEW YORK BOTANICAL GARDEN.

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CORREA DA SERRA AND AMERICAN BOTANY.[1]—The Portuguese diplomat and botanist Correa da Serra (1750–1823) is not often remembered in American botany but he influenced many phases of its growth during the early Nineteenth Century. Indeed, historians often neglected Correa; his name does not appear in the indices of either Henry Adams's or John B. McMaster's extended histories. Arriving an exile from France aboard the American warship, U. S. S. *Constitution* in 1812, then sixty-two years of age, he lived most of the next eight years in Philadelphia. There he met the "American illustrious" through letters of introduction from the "European illustrious." He was an

[1] **The Abbé Correa in America, 1812–1820. The Contributions of the Diplomat and Natural Philosopher to the Foundations of Our National Life. By Richard Beale Davis. Trans. Amer. Philos. Soc., vol. 45, pt. 2, pp. 110, 6 *figs.* May, 1955, $2.00.**

admired and admiring friend of former President Jefferson. Three years after Correa's death Jefferson wrote of him to Dr. John P. Emmet: "I suppose you were well acquainted, by character, if not personally, with the late Abbé Correa, who passed some time among us, first as a distinguished savant of Europe, and afterwards as ambassador of Portugal, resident of our government. Profoundedly learned in several other branches of science, he was so above all others in that of Botany; in which he preferred an amalgamation of the methods of Linnaeus and of Jussieu, to either of them exclusively." Professor Richard Beale Davis of the University of Tennessee's Department of English has brought together the correspondence of Abbé Correa in America, 1812–1820, in a satisfying documented commentary. Davis considers Correa's botanical contacts in some detail (pp. 112–115), and the plant references appearing in his letters are noticed *passim* in this 110-page memoir. There are 26 "botanical names mentioned" in the index. Abbé Correa had three close friends in Philadelphia: Zaccheus Collins, William Maclure, and John Vaughan. The quartet supported Thomas Nuttall in his expedition to Arkansas, 1818–1820, and he dedicated his *Journal of Travels into the Arkansa Territory* to them. Earlier Nuttall had dedicated his *Genera* (1818) to Correa.

The Abbé took a lively interest in plant morphology and physiology, in circulating planting stocks, seeds, and information among a wide circle of correspondents beginning in 1772, when as a student he was corresponding with Linnaeus, to later years when he was in touch with Thouin in France, and Joseph Banks, Robert Brown, and Salisbury in England. Correa and Banks examined the Lincolnshire coast together and their account was published in the *Philosophical Transactions.* Colmeiro summarized Correa's pre-American years in 1858 but Professor Carvalho published "the most recent, detailed, and scholarly study" in Lisbon in 1948. Correa was never an important collector in the herbarium sense, however, and few, if any, sheets bearing his name exist in the Academy of Natural Sciences' Herbarium—I have seen none. Davis emphasizes that Correa's real service was in his personal contacts with amateurs, some of whom became important figures probably stimulated by him

The Quaker physician and botanist, William Baldwin, wrote to Dr. William Darlington: "On my passage from Elkton to Baltimore I became acquainted with the 'Chevalier Correa de Serra'—who, I suppose, is known to you. I was pleased with his plainness: and had a good deal of botanical talk with him." Dr. Baldwin had earlier characterized Abbé Correa to Henry Muhlenberg as an "excellent Botanist."[2]

Correa's 16-page pamphlet entitled *Reduction of all the Genera . . . in the Catalogus . . . of the late Dr. [Henry] Muhlenberg to the Natural Families of Mr. DeJussieu's System*, Philadelphia, 1815, of which Professor Davis reproduces the title page for us, was published both separately and as an appendix to the second edition of Muhlenberg's *Catalogus* (1818) and in somewhat altered presentation as an appendix to the New York edition of James Edward Smith's *A Grammar of Botany* (1822). Correa considered Stephen Elliott America's greatest botanist; others who came under his influence included Jacob Bigelow, Thomas Cooper, Francis Walker Gilmer, Reuben Haines, George Ord, Thomas Say, and Caspar Wistar. Dr. Bigelow wrote that he (Correa) "did me the honor to peruse my herbarium, and aid me with his explanations."[3] This was probably in the year 1813 when the two made botanical excursions together in the vicinity of Boston. Correa must have associated with Benjamin Smith Barton, whose botanical lectures at the University of Pennsylvania he continued after Barton's death, but Professor Barton's increasing disability may have minimized those contacts. Five persons are conspicuous for their absence from Correa's correspondence as Davis has reported it: Dr. David Hosack (1769–1835), John Eatton LeConte (1784–1860), Charles Alexandre LeSueur (1778–1846), William Bartram (1739–1823), and Dr. Gerard Troost (1776–1850). Of course letters to or from them may yet come to our notice. Davis refers (p. 107) to a 'literary circle' described by the New York physician, John W. Francis, where Abbé Correa had been a guest. This was surely Dr. Hosack's 'circle' and a search of the Francis papers in the New York Public Library may establish this contact.

[2] Davis does not mention William Baldwin (1779–1819) among Correa's American acquaintances but cf. Darlington's *Reliquiae Baldwinianae*, 114, 172, 250, etc., 1843.

[3] Cf. George E. Ellis, Memoir of Jacob Bigelow, M.D., LL.D., Proc. Mass. Hist. Soc. p. 36 (of reprint), 1880.

Connections which do not come to notice at once will perhaps be detected by a closer scrutiny of the Correa correspondence. For example, Thomas J. Wray of Augusta (p. 103) was a correspondent of Nuttall's and there are collections both at Philadelphia and in the British Museum (Nat. Hist.) labelled in Nuttall's hand as from him. Nuttall evidently met Wray in Augusta sometime in the Fall of 1815. Correa reached Augusta by October 16th that year and Wray must have met the two visitors about the same week if indeed they were not travelling together (?).—Joseph Ewan, tulane university, new orleans, la.

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Nomenclatural Change in the Grass Genus Echinochloa.—The name *Panicum muricatum* Michx. (1803) is invalidated by the earlier use of the binomial by Retzius (1786). Palisot de Beauvois (1812) transferred this species to the genus *Setaria* and in the body of his work merely lists *Setaria muricata;* however, on page 178, he said, "*Panicum muricatum* Michx. equals *Setaria*". This name, invalid in *Panicum*, is valid in *Setaria* since there is no earlier binomial which is identical. The combination *Setaria muricata* is four years older than *Panicum pungens* Poir. (1816) and seventeen years older than *Oplismenus muricatus* Kunth (1829), the basonym discussed by Shinners (1954).

Therefore, Beauvois' "muricata" is the oldest epithet used in a legitimate combination for the taxon; and as such, Fernald's (1915) use of the epithet in *Echinochloa* was valid, although in 1935 he adopted the name *Echinochloa pungens* because of the homonym rule.

Since the parenthetical citation refers to the first legitimate use of the epithet, the correct binomial for the indigenous barnyard grass is *Echinochloa muricata* (Beauv.) Fernald.

The essential synonymy is as follows:

*Panicum muricatum* Michx. 1803. Not Retzius 1786.
*Setaria muricata* (Michx.) Beauv. 1812.
*Panicum pungens* Poir. in Lamarck's Encycl. Méth. Bot. 1816.
*Oplismenus muricatus* (Michx.) Kunth. 1829.
*Echinochloa muricata* (Michx.) Fern. 1915.
*Echinochloa pungens* (Poir.) Rydb. 1931.

The writer wishes to express his appreciation to Dr. H. W. Rickett of the New York Botanical Garden for his assistance.—David E. Fairbrothers, botany department, rutgers university, new brunswick, n. j.

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Two Plants New to the Illinois Flora.—While examining some of the unmounted material of my 1951 collections, I found one species that apparently had not been reported previously from Illinois. During recent field work in Montgomery County, I located another species not reported from the state. The specimens, cited below, are in the herbarium of the Illinois State Natural History Survey (ILLS).[1]

Dicliptera brachiata (Pursh) Spreng. Fernald[2] gave the range of this species as "Fla. to La. and Okla., n. to se. Va., s. Ind., Mo. and e. Kans." Deam[3] cited its occurrence along Little Pigeon Creek, a stream that discharges into the Ohio River in Warrick County, Indiana. Palmer and Steyermark[4] reported the plant from a number of counties in east-central and southern Missouri. Now southern Illinois can be included in the range. I found this species east of Joppa, in a bottomland woods along the Ohio River. The plant had flowered and was in fruit when I made the collection. The herbarium sheet includes the following data: massac co.: Bottomland woods, east of Joppa, September 20, 1951, *R. A. Evers 32944*.

[1] ILLS is the abbreviation given by Lanjouw and Stafleu in the Index Herbariorum, Part I, 1952, for the herbarium of the Illinois State Natural History Survey.

[2] Gray's Manual of Botany, ed. 8. 1950.

[3] Flora of Indiana. 1940.

[4] Mo. Bot. Gard. Ann. 22: 646. 1935.

Haplopappus ciliatus (Nutt.) DC. Fernald (l. c.) recorded the range of this plant as "w. Mo. to Colo., s. to Tex. and N. M." Illinois is east of this range. Nevertheless, I found this species growing on the shoulder of an intermediate type bituminous road—often referred to locally as a black-top road—between Fillmore and Van Burensburg, in Montgomery County. South of Fillmore only a few plants grew on the shoulder, but north of Van Burensburg many plants occupied the shoulder at the edge of the black-top pavement for some distance along the highway. Herbarium sheets contain the following data: Montgomery co.: Roadside, 2 miles south of Fillmore, August 12, 1955, *R. A. Evers 48782;* roadside; north of Van Burensburg, August 12, 1955, *R. A. Evers 48819.*—Robert A. Evers, illinois state natural history survey, urbana.

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Juniperus communis var. saxatilis from Mount Washington.—In checking over some old botanical material this summer, I discovered a specimen of a juniper that I had collected. on the cone of Mount Washington in 1939. After studying it carefully, I became convinced that it was *Juniperus communis* L. var. *saxatilis* Pallas. I showed it to Professor A. R. Hodgdon and to Professor A. S. Pease, both of whom had no hesitation in confirming the identification.

This variety is known from Mount Katahdin, from the coast of Maine, and from the coast of Massachusetts, but there is no record of it from New Hampshire. No juniper has been collected from Mount Washington, although var. *depressa* Pursh occurs sparingly in Coos County in old fields and on ledges. It might be expected that birds would occasionally carry the fruits above the tree line, allowing small colonies to become established. It is difficult to account for the presence of variety *saxatilis* here. I am anxious to relocate the station and collect more material, but was unable to do so last summer. My sheet has been deposited in the Herbarium of the New England Botanical Club.—Frederic L. Steele, st. mary's-in-the-mountains, littleton, n. h.

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# THE ECOLOGY OF THE NATURAL ORIGIN OF A SPECIES OF CAREX BY HYBRIDIZATION

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IN the upper Kuskokwim River Region of Alaska, there is a population of *Carex* which seems to be of hybrid origin. I feel that the biology of this population indicates that it has reached species status, because it fruits abundantly over a wide area and maintains its identity both in the presence and absence of the suggested parental species, *Carex rotundata* Wahlenb. and *Carex rostrata* Stokes.

The population appears in a mixed environment which is produced when sphagnum bogs invade sedge swamps coincident with special soil processes related to the age of the floodplain and to the conditions of perennially frozen ground. In the environment thus created the hybrid population has had partial ecological isolation and seems to have persisted by vegetative reproduction until sexual reproduction has become established. The population has thereby become independent of resynthesis and is genetically integrated.

In a paper that will appear as *Contributions from the Gray Herbarium of Harvard University*, No. 178, I have described the changes in the alluvial deposits and the vegetation on the floodplain of the Upper Kuskokwim River. The physiographical and botanical processes briefly treated here are discussed in detail in that paper.

## THE FLOODPLAIN AND ITS VEGETATION

On the youngest parts of the floodplain of the Kuskokwim River there is a tall forest of Balsam Poplars (*Populus balsamifera*),

White Spruce (*Picea glauca*), or White Spruce mixed with White Birch (*Betula papyrifera*). On the flooded shores of sloughs, ox-bows and bar lakes in this well-drained area there are zonations of vegetation from emergent grasses and sedges to willows. *Carex rostrata*, one of the putative parent species, grows just at the upper limit of average water-level in shallower water than *Carex aquatilis* and *Glyceria* and on wetter places than *Calamagrostis canadensis*.

The older parts of the floodplain have a thick carpet of moss the insulating effect of which leads to the preservation of frozen ground and the accumulation of surface water. The oldest floodplain surfaces have a forest of Black Spruce (*Picea mariana*) and a floor of sphagnum. Scattered in this forest are many large bogs. These bogs are of a treeless peat bog type characterized by an abundance of sedges, including *Carex rotundata*, the other putative parent of the new species. The zones of different age of the floodplain merge into each other and between the youngest and the oldest is a broad zone of transition both in the vegetation and in the conditions of the alluvium. Over most of this older part of the floodplain, bogs are actively invading ox-bow and bar lakes, swamping the forest floor and thawing into the frozen subsoil undermining and destroying the forest. Shallow lakes and sloughs have been initially bordered by the vegetation of silt shores, then peat mosses have colonized and have replaced the shore vegetation. The combination results in a mixed environment and, as would be expected in such an unstable environment, species of sphagnum and higher plants appear which are not present in either the pure peat bog or the pure mineral silt environment. Such species are, for example, *Sphagnum teres*, *S. Ångströmii*, *S. recurvum*, *S. riparium*, *S. robustum*, *S. fimbriatum*, and *S. plumulosum*, *Carex chordorrhiza*, *C. tenuiflora*, *C. canescens* var. *subloliacea*, *C. magellanica*, *Cicuta mackenzieana*, *Chamaedaphne calyculata* var. *angustifolia*, *Galium tinctorium* and *G. Brandegei*. In such areas where bogs invade a silt-bottomed pond, *Carex rostrata* occurs on the silt shores and *Carex rotundata* in the peat bog. Between them is a large unstable area where the area available for growth of any individual is nearly unlimited, and vegetative reproduction is widespread.

In such areas, where peat bogs are invading sedge sloughs, I have collected a plant which is intermediate between *Carex*

*rostrata* and *Carex rotundata*. Because of the forces active in modifying the wet lands of the Upper Koskokwim River lowlands, invading bogs are more widespread than either "typical" type and the intermediate plant, named here *Carex paludivagans*, is more common and widespread than either of the "parent" species. These plants are readily recognized by their folded, stiff and coarse leaves and two rather dense pistillate spikes containing tightly packed, brownish perigynia.

The various alternative explanations of this population are: a) that this population is an extreme variant of one parent released under special conditions of the habitat, b) that it is a separate species which had an origin independent of *C. rostrata* and *C. rotundata*, c) the parents and the present population are all variants of the same species, d) that this is a population intermediate between the two "parent" populations and not a separate species.

In the following pages reference will be made to certain numbers such as *3271*, *4659*, or *1667*. These are the field numbers assigned to specimens when collected and recorded in a field catalogue. Such numbers represent a single collecting site and 10–15 plants collected at that site. Each is a single sample of a local population.

## Carex paludivagans

In the course of the field work this apparently quite distinct population was considered a separate unidentified species and, as a result, proper mass collections were not made. Furthermore, the newly synthesized populations represented in field numbers *3263* and *3265* were not appreciated to have any application to this complex.

Final studies have shown that all of the characters of the large intermediate population lie well within the extremes of variation expressed in the two parents, as shown in Table 1. The habitat itself presents a blending of the parental physiological requirements and is an unstable habitat in keeping with studies of hybrid populations made by others. The possibility remains, of course, that I have not been able to find the particular characters which might show an origin completely independent of the suggested parents, but this is unlikely since a systematic review of all the features usually used in descriptions of *Carex* was made in com-

TABLE 1A

TABULATION OF CHARACTERISTICS

| | **C. paludivagans** | **3263 (pt), 3265** | **2084, 3263 (pt)** | **4341, 2169** |
|---|---|---|---|---|
| Habitat | mixed bog and silt shore | edge of bog-invaded slough | edge of bog-invaded slough | edge of bog-invaded lake |
| Plant height—cms. | (40)45–50(60) | 55–85 | 50–80 | 42–65 |
| Plant base | rather coarse and soft | coarse and soft | coarse, soft, shoots reddish | coarse, soft, shoots reddish tinged |
| Leaf width—mms. | 1–2.5 | 1–2.5 | 5–7 | 3–4 |
| Leaf character | folded glaucous | folded to involute | flat grey-green | flat, grey-green |
| Septate nodulose | obscurely to conspic. | conspicuously | conspicuously | conspicuously |
| Inflorescence length—cms. | 5–17 | (8)10–12(18) | 18–23 | (10)15–18(23) |
| No. male spikes | 1–3 | 1–3 | 2–4 | 2–3 |
| Longest male spike—mms. | 22–45 | 26–38 | 38–54 | 25–60 |
| No. female spikes | (1)2 | 1–2 | 2–3 | 2–3 |
| Longest female spike—mms. | 11–35 | (14)20–30(35) | 23–58 | 25–55 |
| No. perigynia in longest spike | (40)60–80(90) | 34–120 | 87–145 | 63–140 |
| Arrangement in spike | packed to rather loose, ascending to spreading | tightly packed, spreading | tightly packed, squarrose | loosely packed, ascending |
| Perigynium shape | elongate oval tapering to beak | obovate, abruptly beaked | ovate, plump at base tapering to beak | broadly oval or ovate, rather abruptly beaked |
| Perigynium length—mms. | 4–4.5 | 3–4.3 | 4.5–5.2 | 3.5–4 |
| Beak length—mms. | 1–1.5 | 0.2–0.4 | 1.1–1.6 | 0.4–0.8 |
| Beak teeth, length | 0.1–0.2 | 0.1–0.2 | 0.2–0.6 | 0.1–0.3 |
| Beak teeth | acute | blunt to acute | acute to acuminate | acute to acuminate |
| Female scale | blunt to acuminate | acute to long acute | abruptly acute, aristate | narrowly acute |
| Perigynium color | straw or tan, brown or dark brown apex and beak | yellow brown with occasionally dark brown apex and beak | straw color with brown apex and beak | yellowish tan with often darker apex and beak |
| Perigynium texture | membranaceous | membranaceous | membranaceous | stiffly membranaceous |
| Perigynium stalk | absent | absent | absent | nearly absent |
| Color of female scale | pale purplish brown, hyaline margin and midrib | pale purplish brown, hyaline margin, light midrib | reddish brown, hyaline margin and light midrib | purple brown with narrow hyaline margin and light midrib |
| Lowest bract | ascending spreading | ascending | ascending | ascending |
| Width of lowest bract—mms. | 1.5–2 | 1–3 | 4–5 | 2–2.5 |

TABLE 1B

TABULATION OF CHARACTERISTICS

| | C. rotundata | 3844 | C. membranacea | 3819, 3820 | C. rostrata |
|---|---|---|---|---|---|
| Habitat | Sphagnum-sedge meadow | wet sphagnum-sedge slope | wet mineral soil | wet sedge-moss slope | silt pond shores |
| Plant ht.—cms. | (15)25–30(40) | 29–32 | 25–42 | 32–35 | (60)80–100(120) |
| Plant base | slender, stiff brown | slender, rather stiff, brown | coarse, rather soft, reddish | coarse, soft reddish brown | coarse, soft, shoot reddish tinged |
| Leaf width—mms. | 1 | 1 | 3–4 | 3.7–4.2 | 4–8.5 |
| Leaf character | involute glaucous | involute glaucous | flat, green | flat gray-green | flat, gray-green |
| Septate nodulose | obscurely | obscurely | obscurely–conspic. | conspicuously | conspicuously |
| Inflorescence length—cms. | 3–8 | 3.5–7.5 | (3)4.5–6(12) | (5)7–9(12) | 13–*18*–30 |
| No. male spikes | 1(2) | (1)2 | (1)2 | (1)2(3) | 3 |
| Length of longest male spike—mms. | 12–26 | 17–24 | (9)16–20 | 20–35 | 36–*44*–95 |
| No. female spikes | 1(2) | 1–2 | (1)2(3) | (1)2(3) | 2–4 |
| Length of longest female spike—mms. | 7–13 | 10–15 | (15)20–30(45) | (10)25–30(40) | 21–*32*–75 |
| Perigynia per longest spike | (20)–*35*–(45) | (21)28–36 | 42–*58*–65 | (42)70–100(141) | (90)140–180(210) |
| Arrangement in spike | packed to rather loose, spreading | rather loose, ascending spreading | rather loose, spreading | rather loose, ascending spreading | loose, ascending to slightly spreading |
| Shape of perigynium | oval, abruptly beaked | ovate to orbicular, abruptly beaked | oval to ovate abruptly beaked | ovate tapering to beak | oval to lanceolate tapering to beak |
| Perigynium length—mm. | 3–3.5 | 2.3–3 | 2.5–3 | 4–5 | 5–*6.5*–12 |
| Beak length—mm. | 0.2–0.5 | 0.5 | 0.5 | 0.8–1 | 1.5–2.0 |
| Beak teeth—mm. | 0.1–0.2 | 0.1 | 0.2–0.3 | 0.1–0.2 | 0.4–0.7 |
| Beak teeth | blunt | blunt | acute to narrowly acute | acute to narrowly acute | acute to narrowly acute |
| Female scale | acute | acute-acuminate | narrowly acute | acute to narrowly acute | acuminate to aristate |
| Perigynium color | tan | tan to purplish | purplish | tan to tan with purplish apex | tan to pale brown |
| Perigynium texture | rather indurate | membranaceous | membranaceous | membranaceous | rather indurate |
| Perigynium stalk | absent | present | present | present | nearly absent |
| Color of female scale | tan | purple-black | purple-black | purple-black light midrib | dark, purplish brown, light margin, occasionally midrib |
| Lowest bract | divergent | ascending | ascending | ascending | ascending |
| Width of lowest bract—mm. | 1 | 1 | 2 | 3 | 3.5–4.5 |

paring the three populations involved and in writing a description of the new species.

The second alternative explanation of this population is that it is an extreme variant of one of the parents elsewhere suppressed by competition. The two parent species occur all across Europe from northern Scandinavia across Siberia to Alaska and Greenland. In Asia *C. rostrata* occurs south to Kashmir and Korea. In North America it occurs all across the North and south to Utah and Delaware. In Siberia *C. rotundata* occurs south only to 61° north, but is in the Altai Mountains and Sakhalin. In the New World it is known from Alaska. There is doubt that the plants reported from Greenland and the Labrador coast as this species are separable from the Eurasian *C. saxatilis* (Polunin 1943). Since the parental species occupy largely the same area in the circumboreal region it would not be justified to suggest that this population be an extreme variant. If such a variant occurred here it should occur in many places in the range of the parent species where their ranges do not overlap geographically or ecologically.

It is possible that the parents and this population are all variants of the same species, the third alternative, but the diagram of character index (Figure 1) and drawings of the perigynia (Figure 2) show the presence of three clearly unified aggregations of characters. These exist together in one area. If these were indeed variants of the same species it would go against all experience of field naturalists and what is known at present of the nature of species barriers and the maintenance of population integrity. If similar occurrences that are found in other parts of the range are considered, *Carex saxatilis*, *C. physocarpa*, *C. rostrata*, *C. rotundata*, and *C. membranacea* would then all have to be included in one polymorphous species.

There remains the possibility that this is indeed a hybrid population, but one which has not the identity nor the integrity of a species. This is the most serious objection to the naming of this population as a species, and one that can only be answered by qualitative arguments.

Seeds were brought back and germination tests made, but these failed. No seeds of either "parent" or of *C. paludivagans* germinated. Forty to sixty per cent of the perigynia, however,

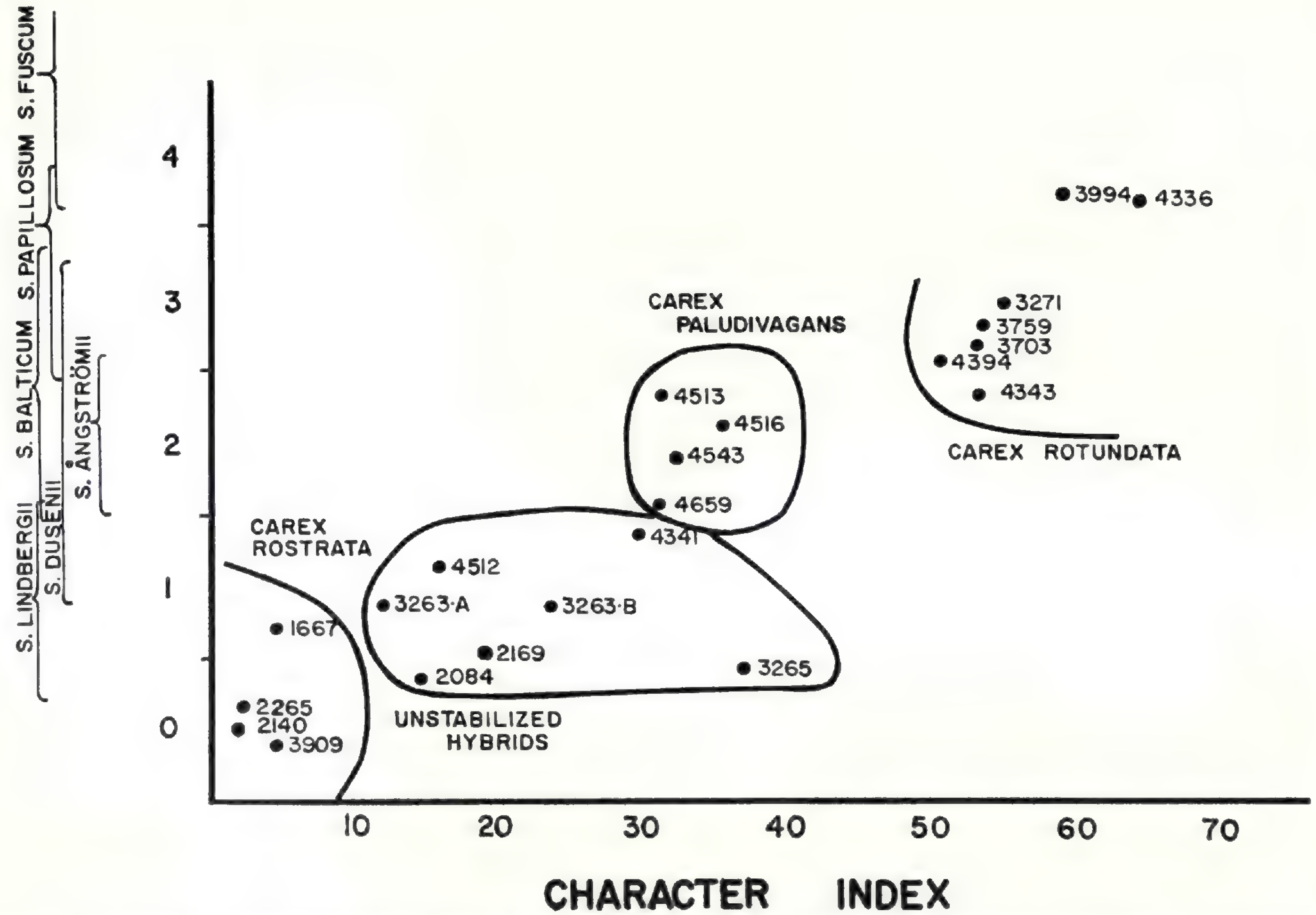


FIGURE 1. Species characteristics plotted against habitat. The individual morphological characters are given a numerical value according to Table 2, and their sum plotted against the spectrum of habitat variation. *Carex rostrata* collections appear on the bottom left of the plot and *Carex rotundata* collections on the top right. *Carex paludivagans* appears in the middle, partially separated from the recent hybrids.

contain achenes that are normal in appearance, not shriveled, and as large as those of the "parents." In one collection, anthers were found containing a mass of shriveled, presumably sterile, pollen but plump pollen grains that stained deeply with lacto-phenol and cotton blue were also found on the same specimen. Most of the pollen, of course, had been shed by the time the ripe perigynia represented in my collections were formed, but one or two plump pollen grains that stained could be found on each collection sheet of *C. paludivagans*.

In most bogs *Carex paludivagans* and *Carex rotundata* were abundant and *Carex rostrata*, although very localized, could be found in isolated reëntrants. In most of the bogs where all three occurred, the populations were quite distinct, but in several cases part of the bog on the border of a stand of one parent had a very variable, sterile and evidently hybrid intermediate stand. In some parts of the valley, intermediate populations were not seen to fruit, but reproduced actively by stolons. In these places the population was probably made of more or less sterile clones from recent hybrid seedlings. Over most of the bog area, however, plants of *C. paludivagans* fruited abundantly, and in three large bogs, I could not find either parent although *C. paludivagans* was present in large numbers and was fruiting abundantly (producing 80% filled achenes). Over most of the valley *Carex paludivagans* is more abundant and widespread than either or both the parents. On this basis I suggest that the population deserves recognition as a species.

These plants have "taken advantage" of the ability of the hybrids to persist by vegetative reproduction until chance rearrangements of genes or chromosomes and environmental selection allowed sexual reproduction to occur and a balance of characters suitable to the habitat to emerge. The widespread asexual reproduction provides increased chances for such rearrangements to a balanced gene system. The constant renewal of the unstable habitat leads to resynthesis of the hybrid many times. Long life and asexual reproduction have greatly increased the chances of survival and the ultimate success of a hybrid of this type, while such a population among short-lived, usually only sexually reproducing, animals would be doomed before chance rearrangements toward fertility occurred.

## Detailed Analysis of the Characters

Figure 2 shows drawings of samples of perigynia and pistillate scales from the field collections that will be discussed in the following paragraphs. In several places where both parents are numerous and grow very close together, a very variable intermediate population has been found between them (vis. 3263-A, 3263-B, 3265; Fig. 2). In most other areas a homogeneous population occupies a large area relatively isolated from the parents. To test whether there is any reality to the impression that there is an integrated separate population, a character index was constructed similar to that used by Anderson and Hubricht (1938) or Sibley (1954). The 16 characters rated were plotted against habitat and habitat was classified according to position in the spectrum from swamp to bog, and to degree of disturbance. Figure 1 shows the result of this tabulation. In it ideal *C. rostrata* would have a value of 0 and ideal *C. rotundata* have a value of 64. The characters used and the values assigned are documented in Tables 1 and 2 since in constructing an index such as this there is danger that in the selection, values assigned are biased toward producing the desired results. Particular values assigned each character of all the field collections are shown in Table 3.

Four divisions of habitat were erected for classification of the habitat as follows:

0 : silt shores of an ox-bow or bar lake located in the White Spruce and deciduous forest.

1 : shore of an ox-bow bog or pond recently invaded by bog sedges and mosses; silt is found in the roots of specimens; plants present include *Equisetum fluviatile*, *Potentilla palustris*, *Sphagnum Lindbergii*, *S. Dusenii*, and species of *Drepanocladus* and *Calliergon*.

2 : wet sedge-meadow of a deep bog on the margin of a lake or deep pond invaded by bog vegetation characteristically accompanied by *Sphagnum balticum*, *S. Dusenii*, *S. recurvum*, *S. riparium*, *S. Ångströmii*, *S. teres*, and *Carex chordorrhiza*.

3 : Wet sedge meadow in *Strangmoor* areas, or on the upper parts of flat bogs which have advanced by swamping up a drainage, characteristically part of a simple association with sphagnum (*Sphagnum balticum*, *S. Dusenii*, *S. papillosum*, *S. pulchrum*, *Carex limosa* and occasionally *C. rotundata*).

4 : dry sedge-meadow or a shallow isolated pot hole; *Sphagnum papillosum* and scattered *Andromeda* and *Myrica*. Where this is drier *Drosera rotundifolia*, *Chamaedaphne*, *Vaccinium uliginosum*, *V. Oxycoccus* and *Sphagnum fuscum* appear.

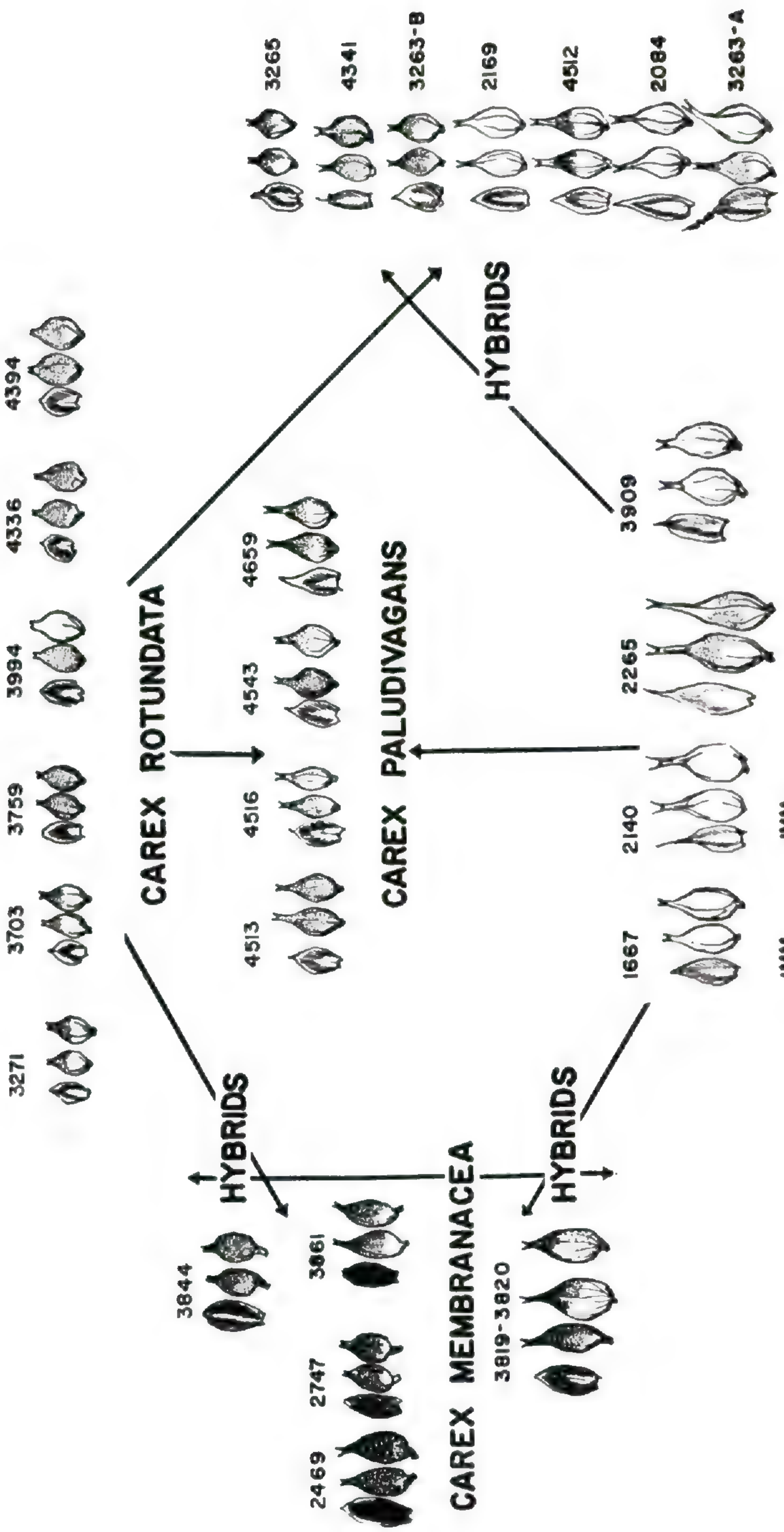


Figure 2. Perigynia and female scales. Field numbers are given above each illustrated sample. Recent hybrids are illustrated as well as the stabilized populations.

TABLE 2

TABULATION OF CHARACTERS

| Habitat | 0 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|
| Height in cms. | 80–120 | 60–80 | 45–60 | 30–45 | 15–30 |
| Base of plant | coarse and soft | coarse, rather stiff | coarse-grasslike, indurated | coarse-grasslike, rather stiff | slender and stiff |
| Leaf width—mms. | 4–8.5, flat | folded and flat | 1–2.5, folded | folded and involute | 1 or less, involute |
| Septate nodulose | conspicuously | most bases conspicuously | nodulose, but not conspicuously | most bases obscurely | obscurely |
| Inflorescence length in cms. | 20–30 | 15–20 | 8–15 | 5–8 | 3–5 |
| No. male spikes | 3–4 | 2–4 | 2 | 1–2 | 1 |
| Length of longest male spike—mms. | 50–100 | 40–50 | 25–40 | 20–25 | 12–20 |
| No. female spikes | 3–6 | 2–4 | 2 | 1–2 | 1 |
| Length of longest female spike—mms. | 41–95 | 31–40 | 19–30 | 13–18 | 7–12 |
| No. perigynia in longest spike | 141–180 | 81–140 | 61–80 | 41–60 | 20–40 |
| Perigynium shape | long oval to lanceolate, tapering to a beak | long oval, tapering to a beak | elongate oval more or less tapering to beak | ovate to elongate oval, beak clearly separate | oval to orbicular abruptly beaked |
| Perigynium length including beak in mms. | 5–12 | 4.5–5 | 4–4.5 | 3.5–4 | 2.3–3.5 |
| Beak length—mms. | 1.5–2.0 | 1.3–1.8 | 1–1.5 | 0.5–1 | 0.2–0.5 |
| Shape of female scale | narrowly acute to aristate | acuminate, with awn, variable | blunt to acuminate | blunt to acute | blunt |
| Color of perigynium | tan | tan, some perigynia with dark beaks | many tan, and many with a dark apex and beak | tan, most with a brown apex and beak | tan with dark brown apex and beak |
| Lowest bract width in mms. | ascending, flat: 3.5–4.5 | 2–3.5 | ascending—spreading: 1.5–2 | 0.25–1.5 | divergent, involute: 0.1–0.25 |

TABLE 3

| Field Number | 2265 | 2140 | 3909 | 1667 | 3263A | 2084 | 4512 | 2169 | 3263B | 4341 | 4659 | 4513 | 4543 | 4516 | 3265 | 4394 | 4343 | 3703 | 3759 | 3271 | 3994 | 4336 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Habitat | 0 | 1 | 0 | 1 | 1 | 2 | 1 | 2 | 1 | 2 | 2 | 2 | 3 | 2 | 2 | 3 | 3 | 3 | 4 | 3 | 4 | 4 |
| Base of Plant | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 3 | 4 | 3 | 3 | 3 | 4 | 4 |
| Leaf width | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 2 | 2 | 2 | 3 | 2 | 3 | 4 | 2 | 3 | 4 | 4 | 4 |
| Septate nodulose | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 2 | 0 | 1 | 2 | 2 | 2 | 2 | 2 | 4 | 4 | 4 | 3 | 4 | 4 | 4 |
| Inflorescence length | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 2 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 4 | 3 | 4 | 4 | 4 |
| No. male spikes | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 4 | 4 | 4 | 4 | 3 | 4 | 4 |
| Length longest | 0 | 0 | 0 | 0 | 1 | 1 | 2 | 0 | 1 | 2 | 2 | 2 | 2 | 3 | 2 | 3 | 3 | 4 | 3 | 4 | 4 | 4 |
| No. female spikes | 0 | 0 | 0 | 1 | 0 | 1 | 2 | 1 | 0 | 1 | 2 | 2 | 2 | 3 | 2 | 4 | 4 | 3 | 4 | 3 | 2 | 4 |
| Length longest | 0 | 1 | 2 | 2 | 1 | 1 | 1 | 2 | 2 | 3 | 2 | 2 | 2 | 2 | 3 | 3 | 4 | 4 | 4 | 4 | 3 | 4 |
| No. perigynia | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 1 | 1 | 2 | 2 | 1 | 2 | 3 | 2 | 3 | 3 | 4 | 4 | 3 | 4 | 4 |
| Perigynium shape | 0 | 0 | 1 | 0 | 3 | 3 | 1 | 2 | 4 | 3 | 2 | 2 | 2 | 1 | 3 | 3 | 3 | 3 | 3 | 3 | 4 | 4 |
| Perigynium length | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 4 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 4 | 3 | 3 | 3 | 4 | 4 |
| Beak length | 0 | 0 | 1 | 1 | 1 | 1 | 2 | 2 | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 4 | 3 | 4 | 4 | 4 |
| Shape female scale | 0 | 0 | 1 | 0 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 1 | 3 | 3 | 3 | 4 | 4 | 4 | 4 |
| Perigynium color | 1 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 3 | 2 | 2 | 3 | 2 | 2 | 3 | 3 | 2 | 3 | 3 | 4 | 2 | 3 |
| Lowest bract | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 2 | 2 | 2 | 2 | 1 | 2 | 3 | 2 | 3 | 2 | 3 | 4 |
| Total | 2 | 2 | 5 | 5 | 12 | 15 | 16 | 19 | 24 | 30 | 32 | 32 | 33 | 35 | 37 | 50 | 54 | 53 | 54 | 55 | 59 | 63 |

In selection of the habitat index a more or less arbitrary system, in part influenced by the Scandinavian system of classifying vegetation by indicator species, was set up. It was very clear during the field work that there were divisions of the sedge meadow vegetation in addition to the separation of this major type from other major types such as low shrubs, high shrubs, or shallow water with emergent aquatics. In other words, along the disturbance-gradient, clear-cut differences exist to separate a) the sedges growing on silt beaches of ponds b) the sedge meadows of fully developed peat bogs where the sphagnum is usually *S. papillosum* with patches or zones of invading *S. fuscum* and c) the areas of sedge-meadow rich in species of sphagnum and of higher plants. In addition to these major differences there are intermediate sedge meadow types. In the wetter conditions *S. Dusenii* (a dark deep brown sphagnum usually immersed) is especially characteristic and in drier places *S. balticum* (a lighter colored sphagnum usually emergent) is typical. In the field there are three clear divisions. Zones 1 and 3 are less clear. This bog structure has created a natural ecological isolation for the three populations.

It is interesting to realize that again in these bogs there occurs the phenomenon familiar to the botanical collectors that rare species occur together in an unstable habitat. Such unstable habitats are the familiar "good collecting areas". The ecological explanation used here is that unstable or new populations or ones of restricted variability occur in disturbed places. The widespread vegetation is of a few common highly succesful species of many, many more individuals. Unstable habitats are discussed by Anderson (1949) and are of course familiar sites for introduced and native plants to go weedy.

## Interpretation of the Index

The indices show that the population of *C. paludivagans* is as uniform as those of its two ancestors (Fig. 1). It also shows a case, *4341*, of separate synthesis of another hybrid population similar in index although they "look" different. This collection, *4341*, was made 50 miles from the main valley floor in a bog-invaded pond, on wind-blown silt overlying moraine. The plants look like a delicate, small *C. rostrata*,

having more dense spikes and partly folded leaves. It seems to me that this is a separate synthesis of a *C. paludivagans*-type population which does not match exactly. If *C. paludivagans* was hybrid in origin, as is supposed, this repetition of its formation would be expected to occur several times where proper conditions exist, as in this case and that of *3263–3265*. Numbers *3263–3265* were collected from a variable population closely associated with both parents in the bog across the Kuskokwim River west of McGrath. In this bog, *C. rotundata*, growing in *Sphagnum balticum* was found within 30 yards of a large mixed stand of *C. aquatilis* and *C. rostrata*. (A map of this area is shown in *Contributions from the Gray Herbarium* in press.) Number *3271* is *C. rotundata*, and *3263* and *3265* are of the intermediate variable population. Some of these plants are very close to *C. rostrata* and grow on the edge of the patch of that species (on a silt bottom with floating *Sphagnum Lindbergii*). Other plants of these collections have an index even higher than any of the *C. paludivagans* population, indicating that they are closer to *C. rotundata*. This seems to be a mixture of (a) $F_1$ (3265), (b) back-crosses to the *C. rostrata* parent (3263-B) and (c) a second back-cross to *C. rostrata* (3263-A) (Compare the perigynia as shown in Fig. 2).

The whole of the *C. rostrata* population of the valley has been affected by introgression or gene flow. For example, on the margins of some of the bog-filled lakes, there are persistent zones of what in the field look like *C. rostrata* because of the contrast with the sedges in the center. However, when collections of these are analysed their character indices show that they are intermediates. For example, *C. paludivagans 4513* and *4516* were collected in the damp center of a bog in a clogged beaded drainage on the high terrace 70 miles upstream from McGrath. On the margin of this *4512* was collected as *C. rostrata* ("not quite typical"). Index analysis shows it to be of value 16 as if it were the result of an $F_1$ hybrid back-crossed to *C. rostrata*. These plants would casually be identified as *C. rostrata* although they show several intermediate characteristics.

In contrast to this, my collections show little evidence of repeated backcrossing to *C. rotundata*. This may be because of inadequate collections or the variability of the plants included

in *C. rotundata* may indicate that such backcrossing has actually taken place. Alternatively, this may be an expression simply of a variable parental population. Without further evidence all plants with an index over 50 have been assigned to *C. rotundata*.

Probably for the same reason, all those specimens with an index less than 15 should be referred to *C. rostrata*, but I have not done so because of the complication with *C. rhynchophysa* discussed below. In the main area of the flats, *C. rostrata* occupies a relatively restricted habitat on the silt shores and *C. paludivagans* the mixed or transitional habitat. It is interesting to note that far down stream many miles from the flats area, and in the Kuskokwim Mountains, collection *1667* of *C. rostrata* (index 5) was found in a mixed bog habitat considered typical for *C. paludivagans*. Perhaps this is an example of colonization of a marginal habitat by *C. rostrata* where competition is lacking, while near McGrath *C. rostrata* is eliminated from such a habitat by *C. paludivagans*. Alternatively, it could be that genes for such a physiological variant which exist within the parental population find expression only when in an isolated patch removed from the main population. If so, the structural features are little modified correlated with the physiological. That some of the population of mixed parentage does move down river is shown by collections *2169* and *2084*. These two were collected where the Kuskokwim flows through the Kuskokwim Mountains, farther down river than the main bog area. Their habitats are disturbed also. Number *2169* was collected on the silt shores of an oxbow lake which had been entirely invaded by bog vegetation, although there was still conspicuous growth of coarse sedge and horsetails (*Equisetum fluviatile*). Number *2084* was collected on a slack-water beach along the main river among common weeds mixed with plants usually associated with bogs: *Triglochin palustre*, *Scirpus microcarpus*, *Eriophorum Chamissonis*, *Eriophorum angustifolium*, *Juncus alpinus*, *Juncus arcticus*, *Juncus castaneus*, *Ranunculus repens*, *Rumex occidentalis*, and *Rorippa islandica*.

Two collections, *2084* and *3263a*, strongly resemble *Carex rhynchophysa* C. A. Meyer of Hultén (1941) (*C. laevirostris* of Blytt and Fries). A detailed examination and the circum-

stances of their growth make me doubt that they should be identified as this species, especially when there also appear to be hybrids between this (*C. rhynchophysa*) and *C. rostrata*, and between it and *C. rotundata* (*3263, 3265*). The characters of the collections which strongly resemble *C. rhynchophysa* lie within the range of variation included in crosses between *C. rotundata* and *C. rostrata* and it seems preferable to regard them as resegregations of the characters of the two parent species as would be expected from uncontrolled back-crossing (Fig. 1, 2).

The evidence of back-crossing indicates the fertility and vigor of the *C. paludivagans* population. Segregation of the combinations formed in this way and gene flow back into the parental and new populations will provide new combinations and vigorous variability in the new populations of all three. In Table 3, the values assigned in making the character index show this variability. The collections of the three species are uniform in the numbers given, *C. rotundata* 3 and 4, *C. paludivagans* mostly 2, and *C. rostrata* 0 and 1. In contrast, the recently made hybrid populations by their spread of numbers show their variability.

**Carex paludivagans** Drury, sp. nov.

Loosely caespitose perennial of mixed peat and mineral soil environments; stolons about 1 mm. thick and as much as one meter long, horizontal, pale yellow; roots fibrous, 1 to several dm. long; fruiting culms (40–)45–50(–60) cm. tall, bluntly triangular, smooth or sparsely scabrous above, especially in the inflorescence, phyllopodic; culm bases coarse and soft, clothed with conspicuous shreds of previous years leaves; leaf-bases light brown or barely light-reddish-tinged in new sprouts; well-developed leaves 2, 3, or 4 to a fertile culm, below the middle (20–)30–40(–55) cm. long by 1–2.5 mm. wide, folded, obscurely to conspicuously septate-nodulose, stiff, firm, light green, scabrous-roughened especially on the keel and margins toward the attenuate tip; leaf sheaths tight, yellowish-brown-tinged ventrally, the fused margins about 2 mm. broad, whitish or yellow-tinged, hyaline, the throat truncate, but often torn in life to a length of 4–9 mm., the ligule reduced, barely 1 mm. long. Inflorescence 5–17 cm. long; terminal spike staminate, 22–45 × 1.5–2.5 mm., often with 1–2 smaller ones at its base; staminate scales 3.5–5.5 mm. long, acutish, brown, with a tan hyaline margin, apex and midrib; anthers 2.5–2.7 mm. long; filaments about 4 mm. long; pistillate spikes usually 2, sometimes 1, lateral, sometimes the upper lateral ones gynaecandrous, 11–35 × 7–11 mm., oblong; bracts leaflike, 4–20 cm. long × 1.5–2 mm. wide, longest on lowest spike, divergent; the short sheath hyaline below with a purplish, truncate or slightly concave throat; pistillate scales 2.6–3.8 × 1.2–1.5 mm., acute or abruptly acuminate, purplish brown with a white hyaline apex and lighter midrib, containing one conspicuous nerve; perigynia (40–)60–80(–90) to a spike, longer than the scale, 4–4.5 × 1.5–2.4 mm., ascending to spreading,

closely packed to rather loose, oval, ovate or obovate, pale yellow-brown, straw colored or light shining brown, reddish dark brown at the apex and on the beak, inflated membranous, puncticulate, strongly nerved, substipitate; beak 1–1.5 mm. long, bidentate, the teeth 0.1–0.2 mm. long, stiff, acute; achenes 1.3 × 1 mm., obovate, brown, puncticulate, trigonous with blunt angles, concave below, continuous with the persistent, bent style, substipitate, loosely enveloped in the perigynium; stigmas 3, 2–2.5 mm. long, dark.

Laxe caespitosa, perenne, paludicola; stolonibus ca. 1 mm. latis, ad 1 m. longis, flavis; culmis (40–)45–50(–60) cm. altis, glabris basi, sparse scabris supra, phyllopodicis; basis crassis, mollibus, vaginis investis, pallide brunneis, aut castaneis stolonibus juvenibus; foliis 2–3–4, inferne, (20–)30–40(–55) cm. × 1–2.5 mm., replicatis, haud aut conspicue septatis-nodulatis, rigidis, scabris carina et margine ad attenuato apice; vaginis stricte cinctis ore vaginae truncato, hyalino. Inflorescenta 5–17 cm. longa, spico terminale mascule, 22–45 × 1.5–2.5 mm., haud infrequens 1–2 addendo baso; squamis masculis 3.5–5.5 mm. longis, acutis, obovatis, stramineis, pallide margine, apice et nervo centralo; antheris 2.5–2.7 mm. longis; filamentis ca. 4 mm. longis; spicis feminis (1) 2, lateralis, superne lateralia per occasionem gynaecandra, 11–35 × 7–11 mm., oblongis; bracteis divergentibus, 4–20 cm. longis, 1.5–2 mm. latis; breve vagina hyalina ore truncato; squamis feminibus 2.6–3.8 × 1.2–1.5 mm., acutis aut abrupte acuminatis, purpureis, fuscis, hyalino apice et nervo centralo; perigyniis squama longioribus, (40–)60–80(–90) spico, 4–4.5 × 1.5–2.4 mm., ascendentibus aut squarrosis, laxe ad dense compactis, ovalibus, ovatis aut obovatis, straminibus aut pallide nitentibus brunneis, atropurpureis apice et rostrate, inflatis, membranaceis, puncticulatis, glabriis, conspicue nervosis, substipitatis; rostris 1–1.5 mm. longis, bidentatis; dentibus 0.1–0.2 mm. longis, acutis, rigidis; achaenis 1.3 × 1 mm., obovatis, fuscis, puncticulatis, trigonis, continentibus persistente style, laxe involvitis perigyniis; stigmatibus 3, 2–2.5 mm. longis, fuscis.

Soligenous bogs and bog-invaded ox-bow lakes of the Upper Kuskokwim River Region of Alaska. **ALASKA:** In drying area of *Sphagnum balticum* with *Polytrichum* colonizing drier spots in the larger pond at the head of a beaded drainage running east off the high terrace 40 miles upstream from McGrath, Latitude 62° 58′ N and Longitude 155° 09′ W., August 11, 1950, *W. H. Drury, Jr. 4513;* In wet area of *Sphagnum balticum* in the center of larger pond at the head of a beaded drainage running east off the high terrace 40 miles upstream from McGrath, Latitude 62° 58′ N and Longitude 155° 09′ W., August 11, 1950, *W. H. Drury Jr. 4516;* In *Sphagnum Ångströmii* and *S. balticum* in bog-invaded interdune area near the junction of Middle Fork with the Big River, Latitude 62° 57′ N. and Longitude 154° 52′ W., August 14, 1950, W. H. Drury, Jr. *4543* (TYPE in the Gray Herbarium); In *Sphagnum Lindbergii* between bog ridges on top of the middle terrace west of Appel Mountain along Takotna River, Latitude 63° 01′ N and Longitude 155° 36′ W., August 22, 1950, *W. H. Drury, Jr. 4659.* Specimens will be deposited in the United States National Herbarium, the National Museum of Canada, the Gray Herbarium, and the Riksmuseet at Stockholm, Sweden. This citation includes those specimens considered to belong to the species *C. paludivagans.* Recent hybrids between *C. rostrata* and *C. rotundata* are not part of the *C. paludivagans* population. They include numbers: *2084, 2169, 3263-A, 3263-B, 3265, 4341,* and *4512.*

## The Problem of the Name

There are three names published which might be applied to the new population described here or to hybrids between *C. rostrata* and *C. rotundata: Carex rhynchophysa* C. A. Meyer, *Carex laevirostris* Blytt and Fries, and *Carex hymenocarpa* Drej.

*Carex rhynchophysa* and *C. laevirostris* are synonymous. Plants which on morphological grounds agree with this taxon were collected in two places in the Upper Kuskokwim Region. Hultén (1942) reports the species from two other places in Alaska and Porsild (1951) reports it from the Nisutlin River in Yukon Territory. This material does not match the population I have named *C. paludivagans* and is considered to be entirely separate from it. The collection from the Upper Kuskokwim which best matches *C. rhynchophysa* (*laevirostris*) (Fig. 2, No. 3263-A) was taken from a very variable hybrid swarm (*C. rostrata* × *C. rotundata*) and was found with both parents in one small part of one bog. Plants intermediate between No. 3263-A and *C. rostrata* and between No. 3263-A and *C. rotundata* (No. 3265) were found in the same stand. My other collection which matches *C. rhynchophysa* (2084) was also made in a mixed stand but less complete collections were made. The evident hybrid nature of this population throws doubt on the presence of the *C. rhynchophysa* taxon in Alaska. More important as far as the present problem is concerned is that the variable population which matches *C. rhynchophysa* differs in being large and coarse in contrast to the slender and small *C. paludivagans* population. The variable population (3263-A, 3263-B, 3265) differs also by this variability itself from the uniform populations of both *C. paludivagans* and *C. rhynchophysa.*

*Carex hymenocarpa* Drej. was described from Greenland in *Revis. Crit. Caricum Bor. in Terris Danic.*, p. 58; 1841. It is illustrated in Flora Danica Fasc. XLVIII, tab. MMDCCCLIX and described on page 12 of that volume. It is a cross between *C. rostrata* and *Carex saxatilis* L. (which many continental authors consider conspecific with *C. rotundata* and *C. physocarpa* Presl.). In the Upper Kuskokwim *C. rotundata* always has three stigmas and trigonous achenes. *Carex saxatilis* has two stigmas and lenticular achenes. Polunin (1943) reports that he collected sterile material of the hybrid in southwest Greenland

and the illustration in Flora Danica shows a plant with undeveloped achenes and empty perigynia. The plants illustrated have strongly red-purple leaf bases, rather narrow, but unfolded leaves, which are coarser than those of *C. paludivagans*. There are 2 male and 3 female spikes, perigynia are indicated as broadly elliptical in the description, but as illustrated are narrowly elliptical, abruptly contracted into a very short beak; the lowest bract of the inflorescence is ascending and flat; the achene illustrated appears lenticular but there are 3 stigmas protruding from the mouth of the perigynium illustrated next to it. The plants illustrated closely resemble my *4341*, which is a local hybrid resynthesis differing in several respects from the general population of *C. paludivagans*. This number *4341* was originally identified as an aberrant *C. rostrata* rather than *C. paludivagans* and this difference in aspect agrees with that of the plants illustrated in *Flora Danica*. Individual collections from the variable populations of recent hybridization in the Upper Kuskokwim Region can be chosen to match the type specimens of the three names mentioned, but all are evidently of unstable genetic structure, and they do not match *C. paludivagans* in morphology or in uniformity. For these reasons all three names are rejected.

## Other Hybridization Within the Vesicariae

In the Upper Kuskokwim River Region there has been hybridization between nearly all of the species of this section: *Carex rostrata* × *Carex membranacea* Hook. (*3819*, *3820*) and *Carex membranacea* × *Carex rotundata* (3844) have been found in addition to the cases discussed already (Fig. 2). These hybrid stands were of local occurrence and were closely associated with their parents on unstable morainic deposits thinly covered by a shallow bog.

Hultén (1942) reports six specimens that he called hybrids of *C. physocarpa* Presl with *C. rostrata*. He gives them no name but points out that *C. saxatilis*, *C. physocarpa* and *C. rotundata* grade into each other in certain parts of their ranges.

## Discussion

Although there can be no doubt of the importance of geographic isolation in the process of speciation, and of reproductive

isolation as the ultimate criterion of species status in plants or animals, the lack of mobility of plants has resulted in the persistence of transitional evolutionary stages which require special consideration. In many animals complex behavior patterns have developed in response to the problems presented by mobility and consequent repeated overlap of populations. Plants are characteristically subject more to isolation than repeated approximation and complex isolation mechanisms in many cases do not seem to have developed. With the opening of glaciated regions of North America to colonization, the vegetation has been fundamentally disturbed and integrated populations brought into proximity that were previously isolated. Evident results of this are the swarms of variants found in *Salix*, *Betula*, *Quercus*, *Rubus*, and so on, the classification of which has led to dismal failures when based solely on morphological concepts. In these groups, integrated self-maintaining populations preserve their identity in the face of continued and widespread hybridization with neighboring populations.

Among plants, isolation can be on a small scale. Disturbance of conditions by man and a variety of other natural conditions has brought formerly spatially isolated populations together which lack genetic isolating mechanisms and have crossed freely. Plants are long-lived and a hybrid once formed has the opportunity of producing large numbers of sex cells thereby increasing the opportunity for recombination thus increasing the probability that a fertile type capable of perpetuating itself will arise.

Because of the ability of many groups of plants to maintain population integrity within a framework of and in the presence of broad interbreeding, many botanists can accept only degrees of breeding isolation as a criterion of species. Zoologists understandably and correctly consider two populations broadly interbreeding as one species and suggest that botanists do so too. Botanists, however, have found many clear species populations which do overlap broadly and intergrade. It is as if the enforced crossbreeding that can be brought about in captivity within the genus *Anas*, *Papilio*, or *Larus* can be and is brought about repeatedly and locally by disturbance of the site. Both are "artificial" but of a different type of artificiality. Many zoologists deny introgression, calling it gene flow within a species.

Given their definition, this is correct. But the botanists cannot accept this clear, logical, and simple definition because their experience with living material denies it. Experience with populations such as these of *Carex* can be repeated in *Salix* and several other genera of the North. In them consistent groupings of characteristics into integrated populations emerge from a spectrum of variation and interbreeding. They continue to exist in the presence of marginal interbreeding and deny biological reality to a consideration of the whole spectrum as one species. The genetical basis for the emergence of integrated populations or their preservation certainly is not clear, but must be presumed to involve balanced complexes of genes, which are selected as balanced wholes. When hybrids form, as they seem to freely, they are eventually selected against, but individuals persist for a long time. The only measure of their status in the population as a whole is their ability to spread away from the clearly hybrid zone.

In the general stream of evolution of plants, hybridization such as is considered in these species of *Carex* must have been an important force in creating genetic variability on the species level, especially in disturbed areas following glaciation or man's influence. I do not see, however, that Anderson and Stebbins (1954) have established how any really new genetic material can be created out of recombinations. Introgression must remain a detail and one of many mechanisms of change.

## Summary

The transition of habitat from silt-shored sweet-water oxbow lakes to water saturated with organic matter in peat bogs is very widespread in the Upper Kuskokwim River Region and in this transition, a hybrid population of *Carex* has become established. The hybrid population is forming continually and backcrossing to the parents occurs, most conspicuously to *C. rostrata* as indicated by my collections. But, in addition to the variable hybrid swarms present in several bogs, there is a uniform and fertile population which has been segregated and selected out and expanded, that is becoming more abundant and widespread than both parents. This population exhibits little of the variability characteristic of a hybrid swarm and seems to maintain clear genetic integrity without becoming swamped

with gene flow between it and its parents. On the basis of its existence as a discrete, homogeneous, fertile population maintaining its identity, I am convinced that this constitutes a species. Perhaps most important of all it shows clearly the sort of populations found among plants in the field which lead many botanists to conclude that there is no complete agreement with zoologists on details of delimitation of species and the means of their formation. Conditions such as the ones under discussion would be nearly impossible among the higher animals. It may well be that in this population of *Carex* allopolyploidy or some aneuploidy will explain the jump isolation. Cytological studies would decide this, but attempts to germinate seed were unsuccessful.—BIOLOGICAL LABORATORIES, HARVARD UNIVERSITY.

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Availability of Ingredients for Plastic.—In describing the Archer Method for Mounting Herbarium Specimens (Rhodora **57:** 294–299. 1955), I mentioned that Ethocel and Dow Resin were available only in relatively large containers. This statement was based on information supplied two years ago by the Dow Chemical Company. Dr. John R. Reeder called my attention to the fact that this company is now prepared to supply Ethocel and Dow Resin in smaller quantities. Readers might be interested in a recent communication from Dow Chemical Company in which Dow Resin 276-V2 is offered for sale in small quantities at the rate of thirty-two and a half cents per pound, f.o.b. Midland, Michigan. Similarly, Ethocel is quoted at eighty-one or eighty-six cents per pound depending upon the viscosity rating.—Reed C. Rollins, gray herbarium.

# THE PROBLEM OF LEAVENWORTHIA AUREA

Reed C. Rollins

To one who became acquainted with *Leavenworthia* largely by seeing and studying the great profusion of these plants covering acres of cedar glades, hillsides and fields in early spring in the Central [Nashville] Basin of Tennessee,[1] it has been a puzzle as to why one of these lavender to white flowered species should be regularly passing under the name *Leavenworthia aurea*. True, there is a yellow-flowered form of *L. stylosa* that seems to dominate the thin-soiled areas of parts of the Central Basin but in nearly every population there are at least some lavender-flowered plants and there are often fairly extensive patches. In my experience, the reverse situation is more frequent in *L. stylosa*, so far as flower color is concerned. Most of the plants are lavender-flowered with a yellow "eye" and there is frequently present the odd yellow-flowered individual or at times patches of yellow-flowered plants. A close examination of the yellow-flowered and the lavender-flowered plants does not readily reveal correlated differences and it is easy to conclude that these are merely two color phases of a single species. Currently, *L. stylosa* is so interpreted.

On the other hand, in population after population of what has been called *L. aurea* in the Central Basin, the flower color is never yellow or even yellowish. There is some variation in color but the range is from lavender to nearly white. The most frequent color observed in three different seasons was light lavender.

In comparing the Central Basin plants with the few collections of specimens available from southeastern Oklahoma, the area from which the type of *L. aurea* came, I have been repeatedly impressed by the differences between the plants of the two areas. The impression that two distinct species were being masked by calling them the same was reinforced in the spring of 1955 when I had the opportunity of studying a large population of *L. aurea*, six miles west of Fort Towson, Oklahoma, which must be close to the type locality for the species.[2] Here, the plants,

[1] Rollins, Reed C. Some Cruciferae of the Nashville Basin, Tennessee. Rhodora **54**: 182–192. 1952.

[2] Baldwin [Bull. Torr. Bot. Club **72**: 373. 1945] appears to favor eastern Texas as the type locality. However, the type location cannot be there for Torrey [Ann.

all yellow-flowered, grow on thin, wet soil, overlying limestone. The habitat is not unlike that of areas in the Central Basin of Tennessee where *Leavenworthia* abounds.

In true *L. aurea*, the siliques are relatively thick, broad, and there is a definite raised margin formed by the replum, while in the Tennessee plants the siliques are thin, narrowed, and lack such a conspicuous margin. The siliques are borne on longer, thicker gynophores and the styles are much thicker in *L. aurea* than in the more easterly material. The thick leaves of *L. aurea*, each with 0–3 pairs of obtuse and scarcely dentate, lateral lobes and a rounded terminal lobe, contrast with the relatively thin leaves of the Tennessee plants, where one finds 3–6 pairs of acute, dentate, lateral lobes on each leaf and a terminal lobe that is definitely angular. The seeds of *L. aurea* are slightly more massive and the funicular cleft is broader and shallower than these same features of Central Basin material. These differences between the plants of geographically separated areas, in addition to the flower color mentioned above, surely indicate that we are in fact dealing with different taxa of specific rank. A description of the Central Basin material, together with citations of specimens for this taxon, are given below.

I had intended to include among the citations some collections from Alabama and Georgia. However, specimens from these states deviate slightly from those of Tennessee. A further study of populations of *Leavenworthia*, including the variations of both the newly proposed *L. exigua* and what is passing as *L. stylosa*, is needed. The early citations of specimens from Alabama, such as those of Peters, of Hatch, and of Buckley, as *L. aurea* both by Gray[3] and by Watson,[4] referred to material that is closer to *L. stylosa* than to *L. exigua*. I have collected what appears to be *L. stylosa* in Lawrence, Franklin, Colbert and Morgan Counties, Alabama, but the material needs further study along with additional field studies of *Leavenworthia* in Alabama and Georgia. Specimens collected by Harper and by Palmer in Jefferson County, Alabama, and by Duncan and

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Lyc. Nat. Hist. 4: 89. 1837] specifically states, "Wet places on the prairies in the vicinity of Fort Towson, Arkansas [now Oklahoma]; also in Texas, and in Jefferson County, Alabama."

[3] Gray, A. Bot. Gaz. 5: 25–27. 1880.

[4] Watson, S. Syn. Fl. N. Am. I: 152. 1895.

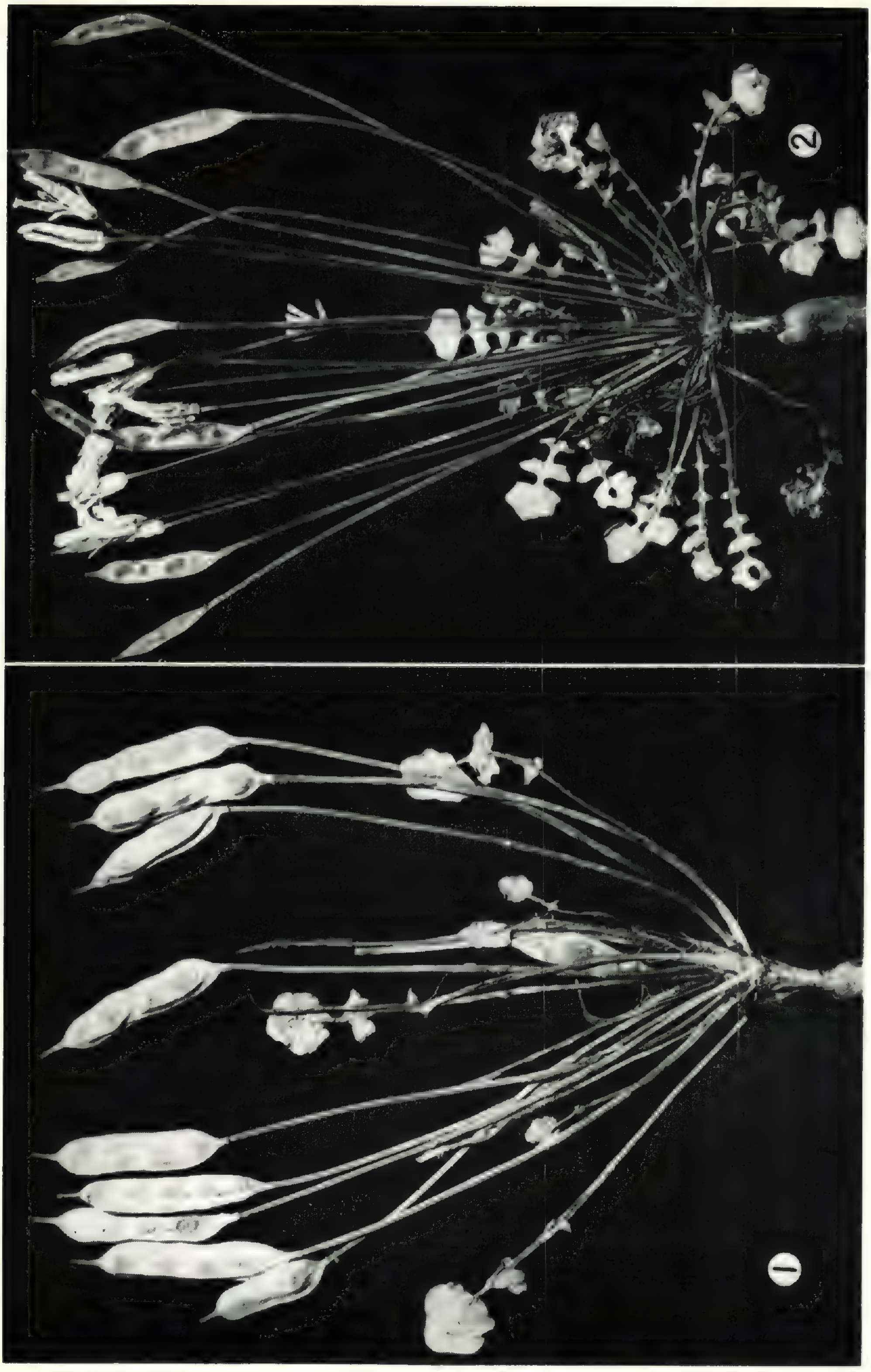


PLATE 1223. LEAVENWORTHIA. Fig. 1, *L. aurea* (Rollins 5535). Fig. 2, *L. exigua* (Rollins 5582).

McDowell in Catoosa County, Georgia, show that a careful study of *L. stylosa* throughout its range is needed. This should probably be coupled with an extensive survey of the chromosome numbers of the various populations. As Baldwin (l. c.) has suggested, *L. stylosa* is the most variable of any of the species of *Leavenworthia*. An interpretation of its relationship to *L. exigua* must remain unstated for the present. Ordinarily, *L. stylosa* and *L. exigua* are easily distinguished on flower size alone, the latter having flowers less than half the size of those of *L. stylosa*.

True *Leavenworthia aurea* appears to be confined to southeastern Oklahoma and eastern Texas. The known collections are still few in number. I have seen the following:—**Oklahoma:** vicinity of Ft. Towson, *Leavenworth* s.n. (GH, isotype); "petals lemon yellow, paler at tips and without, with radial orange streaks at base; pasture, Choctaw County, March 20, 1947, *Rogers McVaugh 7816* (GH); leaves thick and fleshy, petals lemon yellow, clear, slightly emarginate, shallow soil near Rock Creek, 6 miles west of Ft. Towson, April 13, 1955, *Reed C. Rollins 5582* (GH); bottom of depression in black clay, 6 miles northwest of Idabel, McCurtain County, April 19, 1951, *U. T. Waterfall 11825* (OKLA, TEX). **Texas:** open ground, semibarren, marly limestone, San Augustine, San Augustine County, April 1, 1918, *E. J. Palmer 13235* (MO); limestone barrens, same locality, March 28, 1915, *E. J. Palmer 7087* (MO).

**Leavenworthia exigua** Rollins, sp. nov.

Annual; scapose except in occasional plants where the lower, usually decumbent stems are branched; leaves all basal, petiolate, lyrately pinnatifid, 2–6 (–8) cm. long, glabrous, thin, terminal lobe angular, nearly orbicular in outline, 0.5–1 cm. broad; lateral lobes dentate, diminishing toward base, 3–6 pairs, petiole expanded at base; scapes numerous, arising in leaf-axils at crown, leafless, glabrous, erect or the outer slightly decumbent at base, 4–8 cm. long; occasional leafless, branching stems present, bearing a number of flowers on long (2–4 cm.) slender pedicels; flowers usually solitary on the scape; sepals and petals spreading on bright days, closed in reduced light; sepals oblong, 3.5–4.5 mm. long, 1.2–1.5 mm. wide, scarious margined; petals spatulate, emarginate, light lavender to nearly white, 8–10 mm. long, 3–3.5 mm. wide, widest at apex and tapering continuously to a very narrow claw; stamens strongly tetradynamous, filaments of single stamens 2–3 mm. long, curved at base, filaments of paired stamens 4–5 mm. long, straight, anthers 1–1.2 mm.

long; siliques erect, flat, without raised margins, glabrous, 1–1.5 cm. long, 3–4 mm. wide, rounded below, obtuse above, nearly sessile, gynophore less than 0.5 mm. long; styles slender, broadening at base, 1–1.5 mm. long; ovules 3–6 in each loculus, funiculi free, ca. 1 mm. long; seeds flat, nearly orbicular, dark brown, 3–3.5 mm. broad, surface uniformly reticulate, winged, funicular notch deeper than wide; wing not differentiated from body of seed, ca. 0.5 mm. wide; embryo straight, radicle not recurved against the cotyledons.

Herba annua plerumque scaposa; foliis omnibus radicalibus petiolatis lyrato-pinnatifidis lobatis glabris 2–6(8) cm. longis; scapis axillaribus erectis glabris tenuibus 4–8 cm. longis nudis plerumque 1-floribus; sepalis glabris oblongis 3.5–4.5 mm. longis; petalis spathulatis emarginatis lilacinis vel albescentibus 8–10 mm. longis, 3–3.5 mm. latis; siliquis erectis oblongis compresso-planis glabris 1–1.5 cm. longis, 3–4 mm. latis; valvis enervatis; stylis tenuibus 1–1.5 mm. longis; loculis 3–6-ovulatis; seminibus uniseriatis orbiculatis planis brunneis alatis 3–3.5 mm. latis.

Type in the Gray Herbarium, collected 1 mile north of the North Fork of the Duck River, southeast of Unionville, Bedford County, Tennessee, April 3, 1955, *Reed C. Rollins 5535.*

Other specimens studied (all in the Gray Herbarium):—**Tennessee:** cedar glade, 2 miles north of Green Hill, Wilson Co., *Rollins 5310;* cedar glades, Vesta, Wilson Co., *Svenson 7748;* cedar barrens south of Nashville, Davidson Co., *Shanks & Sharp 383* (Exsic. Gray. 1051); cedar glades west of Couchville Pike, Davidson Co., *Svenson 7715;* La Vergne, Davidson Co., April 18, 1882, *A. Gattinger;* mossy creek bank, 2 miles east of Nolensville, Williamson Co., *Rollins 5512;* 4 miles southeast of Kirkland, Rutherford Co., *Rollins 5520;* 5 miles southeast of Kirkland, *Rollins 5524;* cedar glade, 3 miles southeast of Eagleville, Rutherford Co., *Rollins 5529;* 1 mile north of Chapel Hill, Marshall Co., *R. C. & D. Rollins 5216;* 3 miles south of Chapel Hill, *R. C. & D. Rollins 5219;* open glade, 3 miles east of Lewisburg, Marshall Co., *Rollins 5540;* east of Columbia in cedar barrens, north of Duck River, Maury Co., *Sharp, Felix & Adams 11094;* northwest of Shelbyville, Bedford Co., *Sharp, Felix & Adams 11244.*

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A New Form of Nuphar microphyllum from Minnesota.—*N. microphyllum* (Pers.) Fern. f. **multisepalum,** f. nov., sepalis super-numerariis, variabilibus in numeris (2–9). The type collection was made from a colony situated in an opening within a wild rice field (*Zizania aquatica*) along the east shore of Vermilion River about one-half mile upstream from the Gold Mine Camp, Sec. 6, T. 17, R. 66, July 21, 1955, *O. Lakela 18945* (Type in Herb. Univ. of Minn., Duluth Branch).

This striking variant differs from *N. microphyllum* f. *microphyllum* in that it possesses supernumerary sepals variable in respect to number (2–9), in addition to the characteristic 5.

Flowers with a total number of 13 sepals predominate, the minimum being 7, and the maximum 14.

The flowers, seemingly larger than those of the typical form, measured 20–24 mm. in diameter at full anthesis before drying. The additional sepals, golden yellow in color, petaloid in texture are somewhat smaller than the outer sepals to whose concavity they conform.

The plants were growing in a more or less uniform colony throughout the opening about 300 ft. long and 5–20 ft. wide, separated from mid-stream by wild rice fields that flank each bank of the river through a distance of 6 miles above the gorge below which the river ultimately empties into Crane Lake. The upstream end of the opening was colonized by the typical form, with a few plants of *N. rubrodiscum* Morong. Farther up and down the stream, *N. variegatum* Engelm. occurred in large colonies. Other aquatics in the association included *Ceratophyllum demersum* L., in abundance, *Potamogeton natans* L. and *Megalodonta Beckii* (Torr.) Greene.

The specimens collected are fragmentary due to the difficulties of managing the drifting boat in the current that was being activated by winds. The openings in the wild rice fields are really pools of greater water-depth, too deep for the growth of the rice plants. An effort was made to collect each plant as a whole. At least two were uprooted with a pitchfork intact with a rhizome, peduncles, submersed and floating leaves. However by subsequent handling of the tangled petioles and peduncles they became severed, but the parts were carefully pressed together. One of the plants is the type; the other, an isotype, is deposited in the Herbarium of the University of Minnesota at Minneapolis.

Topotype material was collected on Aug. 4, 1955, *O. Lakela & Mary I. Elwell 19075*. These specimens are also fragmentary consisting of basal leaves with young rhizomes, separate floating leaves, and flowering and fruiting peduncles. At this date, due to flooding, many flowers were decaying without fruiting and most floating leaves were riddled by insects.

The typical form of the species is frequently encountered in northeastern Minnesota. In St. Louis Co., from the southern extremity to the Canadian border lakes, it inhabits, with its

congeners, the quiet waters of many lakes and streams. In contrast, *N. microphyllum* f. *multisepalum* is thus far known only from the single location given above.

Gratitude is expressed to the Graduate School of the University of Minnesota for aid in research on the flora of St. Louis Co.—Olga Lakela, university of minnesota, duluth branch.

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Plate 1224. Left: *Cystopteris fragilis* var. *protrusa*, Ann Arbor Twp., Washtenaw Co., Mich., $n = 42$. Right: *C. f.* var. *mackayii*, Plymouth Twp., Wayne Co., Mich., $n = 84$.

# Rhodora

JOURNAL OF

THE NEW ENGLAND BOTANICAL CLUB

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## A DIPLOID VARIETY IN THE CYSTOPTERIS FRAGILIS COMPLEX


W. H. Wagner, Jr. and Dale J. Hagenah


The mere perusal of floristic manuals gives no clue, as a rule, to the genetic significance of many "varieties" listed. For example, sometimes so-called "varieties" are just growth-forms, some of them even the result of injuries. On the contrary, many plants assigned this category possess phylogenetic importance, and in some cases have proved to be genetically isolated from other varieties of the same species. Observations on the ferns included in the *Cystopteris fragilis* complex over the last twenty years indicate more and more strongly that some of the "varieties" may have considerable phylogenetic significance—in fact there is substantial evidence that some may merit interpretation as species rather than as varieties. Excluding those which presently seem to have but little or no importance in forming the populations of northeastern North American *Cystopteris*, there are eight taxa which warrant study to determine their inter-relationships, namely *C. bulbifera* (L.) Bernh., *C. dickieana* Sim, *C. fragilis* (L.) Bernh. var. *fragilis*, *C. f.* var. *laurentiana* Weath., *C. f.* var. *mackayii* Lawson, *C. f.* var. *protrusa* Weath., *C. f.* var. *simulans* (Weath.) McGregor, and *C. f.* var. *tennesseensis* (Shaver) McGregor. Chromosome numbers of all of these forms have not been determined, but those which have been found in previous studies indicated that there might exist a diploid variety of *C. fragilis* with a chromosome number of $n = 42$, since the populations investigated have yielded numbers of $n = 84$ and 126, i.e., tetraploid and hexaploid respectively. The writers have now found such

a diploid variety for the first time, as will be herein reported. We have also studied some of the differences between the two common eastern American varieties, *mackayii* and *protrusa*, which are reputed to intergrade with each other. The evidence to be presented here indicates that they may not actually be able to intergrade, at least in the usual sense.

For making us the loan of the large Gray Herbarium series of these plants, we wish to acknowledge the kindness of Reed C. Rollins. We thank also Edgar T. Wherry and Conrad V. Morton for their assistance in various ways.

DIPLOID VARIETY OF C. FRAGILIS: A number of new chromosome data were presented for these ferns in an earlier article (Wagner, 1955). Two bulblet-producing, suspectedly hybrid, taxa, var. *simulans* and a plant that was tentatively identified as var. *tennesseensis* from the Lake Superior region, were found to possess chromosome complements of $n = 84$ and $n = 126$ respectively. Although the chromosome numbers heretofore known for the putative parents satisfied an allopolyploid hypothesis for the hexaploid "var. *tennesseensis*," the number known in "var. *simulans*" was inconsistent. If the latter were an allopolyploid, the fact that the lowest number thus far reported for *C. fragilis* or any of its known varieties was $n = 84$ did not conform. The possibility was indeed recognized, however, that there might exist now or might have existed at some time in the past more primitive populations of *C. fragilis* in which the chromosome number was diploid, i.e., $n = 42$, as it is in *C. bulbifera*.[1]

We wish to report living populations of *C. fragilis* found in late spring, 1955, that do show the predicted number of $n = 42$. During the course of his investigations of spores in the genus *Cystopteris*, one of us (Hagenah) noticed that unusually small-sized spores occurred in certain collections of this complex that were found in terrestrial situations growing on soil rather than epipetrically on rocks. We decided to make cytological

[1] Prediction of the possible existence, present or past, of diploid *C. fragilis* had already been anticipated by Manton (1950, pp. 121, 122) on different grounds, specifically that two chromosome numbers were known in British and European *C. fragilis*, $n = 84$ and 126. She wrote that "The relationship between numbers as different as 126 and 84 may not at first leap to the eye, yet we can hardly doubt that we are dealing with the upper members of a polyploid series, the lower ones of which are still to seek. If a form with a gametic number of 42 could be found we should have simple series of 42, 84, and 126. . . . It may be that the diploid is extinct."

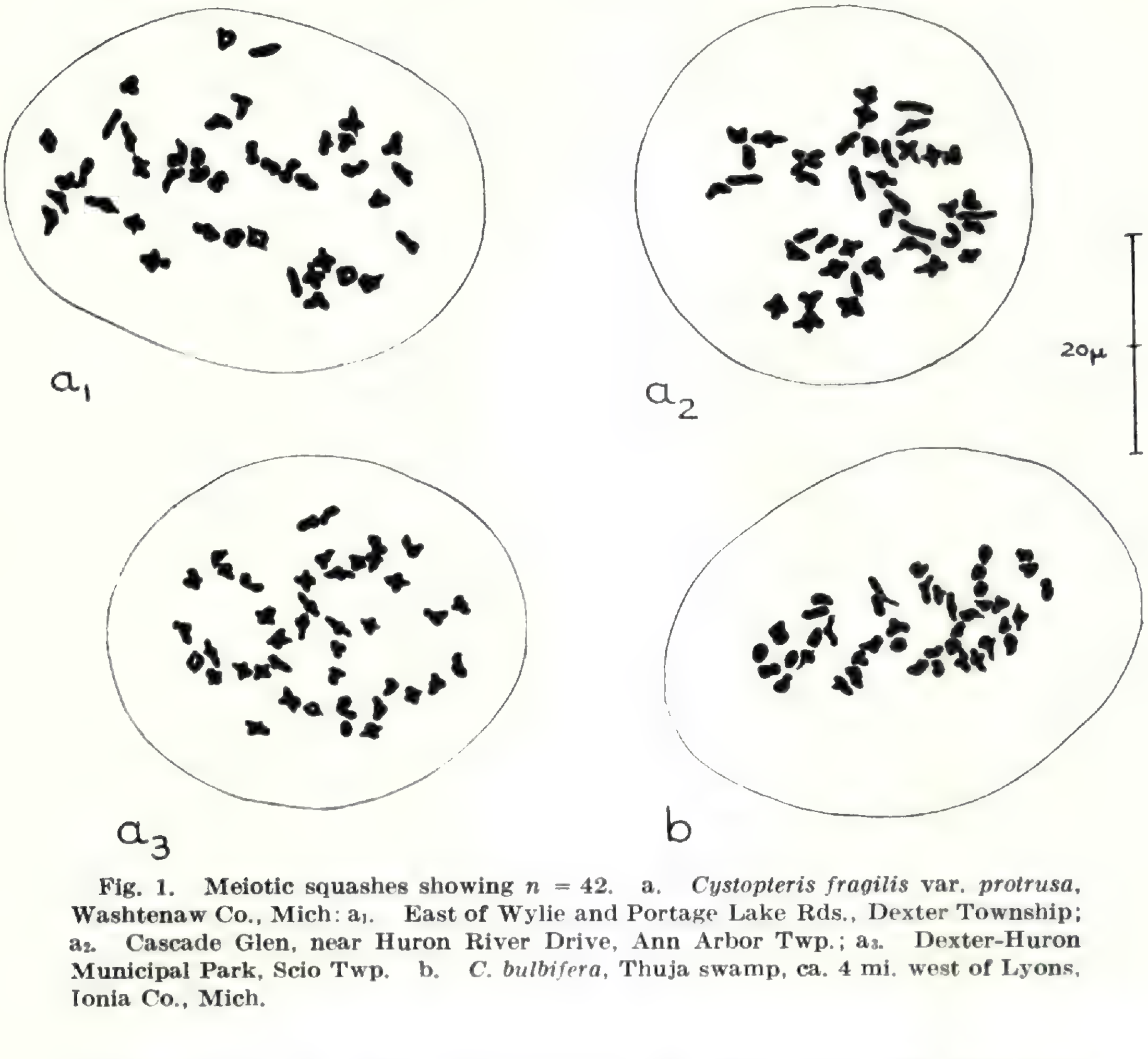


**Fig. 1. Meiotic squashes showing $n = 42$. a. *Cystopteris fragilis* var. *protrusa*, Washtenaw Co., Mich: $a_1$. East of Wylie and Portage Lake Rds., Dexter Township; $a_2$. Cascade Glen, near Huron River Drive, Ann Arbor Twp.; $a_3$. Dexter-Huron Municipal Park, Scio Twp. b. *C. bulbifera*, Thuja swamp, ca. 4 mi. west of Lyons, Ionia Co., Mich.**

observations on such populations, as they occur in southern Michigan, as soon as the unfolding crosiers of spring formed sori of sufficient size and development to make chromosome counts feasible. In late May, therefore, a preliminary field trip was made, and collections of fixed cytological material and voucher specimens were obtained from two terrestrial populations, one occurring in Lyndon Township, the other in Scio Township, in Washtenaw County, not far from Ann Arbor. The former collection was the first examined: it proved disappointing, the results showing clearly $n = 84$ at meiosis, the same number that had been found in all other North American populations thus far investigated with the exception of the glandular bulblet-bearing plant from the Great Lakes region. The matter was temporarily dropped at this point, and the

other collection was not examined for almost a week; but when observations were made of the latter, the sought-for number was obtained, and meiotic squashes demonstrated that the chromosome number was $n = 42$ (fig. 1).

An attempt was subsequently made to find out whether other terrestrial populations in the vicinity of Ann Arbor could be located of both types, the tetraploid and diploid, and it was especially attempted to determine whether the 84-numbered forms could be separated in the field from the 42-numbered ones. During the following month, three more populations were found of the diploid, and four more of the tetraploid. A list of them (plus two more records of *Cystopteris bulbifera*) is given in Table I.

VARIETIES MACKAYII AND PROTRUSA: It was soon obvious that the tetraploid terrestrial populations represent the taxon *C. fragilis* var. *mackayii* and the diploids var. *protrusa*. These two varieties are considered to be endemic to northeastern North American, and they were carefully described and distinguished by Weatherby in 1935, whose treatment has been followed by all subsequent authors. Both of these varieties differ from the typical one of the species in having indusia of considerably smaller size, the margins of which are nearly entire rather than deeply cleft. Weatherby (op. cit.) distinguished his var. *protrusa* from var. *mackayii* on the basis primarily of its rhizome and the shape of its pinnae. From the present studies it is now possible to give three additional contrasts—their chromosome numbers, the coloration of their stipes, and the laminar textures.

If there are real differences in the respective habitats of the populations of var. *mackayii* and var. *protrusa* that grow on the ground, it is not readily obvious in southern Michigan. It was hoped that there might be evident and consistent differences, but both of the taxa occur in rich woods of the same aspect, shaded by oaks, hickories, maples, and elms, and growing in more or less loamy soil. Poison ivy (*Rhus radicans*) is a frequent associate. Their herbaceous neighbors in the counties near Ann Arbor and Detroit commonly include *Laportea canadensis*, *Aster* spp., *Eupatorium* spp., and *Thalictrum dasycarpum* in the fall; and in the spring such rich-woods plants as *Ery-*

*thronium americanum*, *Dentaria laciniata*, and *Podophyllum peltatum*. In some soils the rhizomes grow nearly or quite superficially on the surface of the ground; in others they may be buried except for their apices. The only real difference we have been able to detect between the habitats of the two taxa is that var. *mackayii* apparently has a much greater amplitude in habitat tolerance than var. *protrusa*. Variety *mackayii* may occur perched up on old logs and woody roots. In the other variety such an occurrence has never been found: all of the populations thus far observed have been growing directly in soil at the level of the ground. Variety *mackayii* not only grows on logs and roots, but will also be found on more or less dry, and sometimes rather exposed, soil road-banks, and, as is well known, grows also readily on rock cliffs, directly in the crevices of the rock.

One of the sharpest distinctions observed in Michigan material of the two taxa involves the relative development of the pigmentation of the petioles. The varieties are illustrated side-by-side in Plate 1224. In var. *mackayii* the stipes are mostly shiny dark-chestnut in color, at least in the lower half. (Typical *C. fragilis* var. *fragilis* from Europe and N. America also commonly possesses this coloration). Very young leaves that were collected and pressed in the early springtime may lack this pigmentation, but only one herbarium specimen that appears to be typical var. *mackayii* in the Gray Herbarium series has been seen which appears to be devoid of the pigmentation in the mature state of the leaf ("mature" in the sense of having fully developed, sporiferous sori.) This is a collection made on the Tennessee River cliffs, opposite Knoxville, by Wherry and Benedict. However, in general, in large, well-developed fronds, the dark coloration of var. *mackayii* may extend even to the first pair of pinnae or sometimes even beyond. The smaller the frond, as a rule, the less extensive is the relative development of the coloration. Judging from the photograph of the Type of var. *mackayii* in the Gray Herbarium (Mill Brook, N. E. Dalhousie, Pictou, Nova Scotia, July 30, 1875, *A. H. Mackay*) the pigmentation of its petioles is the same. In var. *protrusa*, by contrast, the stipes are generally merely greenish or straw-colored. The dark coloration like that in var. *mackayii* occurs only at the very base of the stipe, running

at most only a centimeter up the petiole. Some individuals may have more extensive pigmentation of the stipes, but the color is pale-brownish at most. Also injuries sometimes appear to stimulate dark pigmentation to be produced in certain sectors of the petiole. But the rich, dark chestnut-brown of var. *mackayii* has not been observed.

The thicker texture of var. *mackayii* may be used to distinguish it from var. *protrusa* in the field, especially at the time of spore formation in the spring. On the herbarium sheet, moreover, the distinctions remain in this respect, although not so obviously: the pinnae of var. *mackayii* tend to have a hard "feel" as compared with those of specimens of var. *protrusa*. The leaves of living plants of var. *mackayii* stand much more rigidly upright, and they resist wilting after collection much more than do those of var. *protrusa*. Also the leaves of var. *mackayii* are considerably less fragile, and they do not tend to break at the base as do those of var. *protrusa*.

As is well shown in the typical examples in Plate 1224, the pinnae in var. *mackayii* are generally narrower and more remote than those of the other in fronds of equal size growing in comparable situations. The leaves of var. *protrusa*, on the contrary, are more ample and have a somewhat "feathery" appearance. The latter aspect is due to the fact that the basal secondary segments of var. *protrusa* tend to have definite petiolules, as pointed out by Weatherby in his original description. The lowest segments of var. *mackayii* are mostly more broadly based, and the segments themselves conform in general to Weatherby's description of being only shallowly toothed or lobed, and with a broad, rounded apex, and if more deeply lobed often lanceolate or oblong-lanceolate. The pinnules of var. *protrusa* are more sharply toothed or have more pointed lobes, and they are broader, being usually ovate-lanceolate to deltoid-ovate.

Table I. New Chromosome Counts in Cystopteris

| | *n* |
|---|---|
| *C. bulbifera* (L.) Bernh. | |
| Thuja swamp, ca. 4 mi. W of Lyons, Ionia Co., Mich., June 7 (Wagner 8080) | 42 |
| Rocky woods, Grand Ledge, Eaton Co., Mich., June 7 (Wagner 8078) | 42 |
| *C. fragilis* var. *mackayii* Lawson | |
| Thuja swamp, south of Levering, Emmet Co., Mich., June 24 (Wagner 8087) | 84 |

Thuja swamp, ca. 4 mi. W of Lyons, Ionia Co., Mich., June 7 (Wagner 8079, 8081) ..... 84
Rich woods, near Beck and Plymouth Rds., Wayne Co., Mich., May 27 (Wagner 8074) ..... 84
Roadbank, Embury Rd., near Joslin Lake Rd., Lyndon Twp., Washtenaw Co., Mich. (Wagner 8071) ..... 84
Rock cliffs near Grand Ledge, Eaton Co., Mich., June 7 (Wagner 8077) ..... 84
*C. f.* var. *protrusa* Weatherby
Rich woods, Eberwhite's Woods, Ann Arbor, Washtenaw Co., Mich., May 27 (Wagner 8072) ..... 42
Rich woods, Cascade Glen, Huron R. Drive, Ann Arbor Twp., Washtenaw Co., Mich., May 27 (Wagner 8073) ..... 42
Dexter-Huron Park, Scio Twp., Washtenaw Co., Mich., May 20 (Wagner 8070) ..... 42
East of Wylie and Portage Lake Rds., Dexter Twp., May 29 (Wagner 8075) ..... 42

The rhizomes of the two entities are usually quite unlike, and most authors have emphasized this difference. Those of var. *mackayii* generally have very short internodes, the leaves being borne in juxtaposition, and those of var. *protrusa* have very long internodes, the leaves being, accordingly, very widely separated. In the latter taxon the shoot apex protrudes usually a couple of centimeters, at least, beyond the leaves. This condition does not show of course so well in the fall and winter, and it should be pointed out that when the leaves are not present the individual stems of the two entities can occasionally be confused. For example, certain individuals of soil-grown plants of var. *mackayii* may have long lateral branches, the internodes of which are as long as those of var. *protrusa* or nearly so. Weatherby has already noted (op. cit.) that individual specimens of another taxon (*simulans*) may have repent rootstocks as long and as sparsely covered with old leaf bases as those in var. *protrusa* under unusual conditions of growth "such as, perhaps, the burying of the plant under leaf-mold or earth." We should like to caution collectors that the same phenomenon may also take place in var. *mackayii* as well, and we have some fine examples collected along roadbanks on Roe Road, Lyndon Township, Washtenaw Co., Michigan on September 11, 1955, some of the branches of which have internodes that are fully as long as those that are characteristic in var. *protrusa*.

DISCUSSION: The two taxa under consideration here may be separated by an ensemble of four morphological characters

(internodal length of rhizomes, coloration of stipes, texture of the laminae, and cutting of the leaves) and by the cytological difference in chromosome number. Although any one of the morphological characters may overlap in some cases in the two entities, as a group the morphological characters "hold together" sufficiently to make their identification dependable. The difference in chromosome number indicates that in all probability the plants do not "intergrade" in the genetical sense. (The possibility exists, however, of solitary intermediate, sterile, triploid hybrids arising, and forming clones, and we should probably seek such forms where the parents grow in proximity.) The two taxa are almost undoubtedly well isolated from each other because of their different genomes, and steady and gradual gene exchange between them is unlikely.

The diploid *protrusa* is a southern variety primarily, ranging considerably south of the known tetraploid taxa in the *Cystopteris fragilis* complex; it apparently gets no further north than southeastern New York and Minnesota. In Michigan it appears to be confined to the southern part of the state. Taxon *mackayii* extends in the east only as far south as North Carolina, Tennessee, and Missouri, and there only in the uplands, while *protrusa* ranges as far south as Alabama and Louisiana. *Mackayii* may be found northward all the way to the Canadian borders, extending at least into southern Quebec. In Michigan it ranges throughout the state, including the Upper Peninsula.

The question of the taxonomic interpretation of these two taxa is now emphasized by the recent conclusion of Löve that when different chromosome numbers are met with in morphologically distinguishable types, those types should be considered not as "intraspecific chromosome races" but as distinct species. Should "var. *protrusa*" and "var. *mackayii*" be regarded as species? Due to the sterility barrier of different chromosome numbers, such types are not classifiable, according to Löve (1955) as subspecies or varieties only, but they should be classified instead into the category of separate species. In the present case, there is no question that real morphological (and, judging from what is known of their ranges and habitat amplitudes, physiological as well) differences do exist between the taxa *protrusa* and *mackayii*. It is conceivable, therefore, that

we shall in the future be led to interpret them as distinct species, coordinate with *C. bulbifera* and *C. montana*. However, it would be premature to take this action until the whole world-wide complex is subjected to examination, and we hope that such a broad investigation will materialize.

## Summary

Earlier studies of the *Cystopteris fragilis* complex led to a prediction that a diploid variety might exist. Such a diploid has now been found, with $n = 42$, in terrestrial habitats in southern Michigan. The diploid is var. *protrusa* Weatherby; but a tetraploid in the same region is var. *mackayii* Lawson. Studies of these two taxa revealed some distinctions not heretofore emphasized, and they may be separated by the following ensemble of characters: (a) internodal length of stems; (b) coloration of petioles; (c) texture of laminae; and (d) cutting of leaf-blades. Since the taxa are well isolated by their different genomes, and since they are readily distinguished morphologically, they may constitute distinct species.—UNIVERSITY OF MICHIGAN, ANN ARBOR, AND CRANBROOK INSTITUTE OF SCIENCE, BLOOMFIELD HILLS, MICHIGAN.

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# ON AUTHORS' CITATIONS IN PLANT NAMES

H. A. Gleason

At my left hand as I write I see printed the binomial *Tomanthera auriculata* (Michaux) Rafinesque; four words and two parentheses in a binomial. At my right is a copy of the International Code of Nomenclature opened at Section 7, which deals with the "citation of authors' names and of literature for purposes of precision." Possibly we may learn something about author-citations if we read these rules carefully.

The purpose of the whole section is shown in Article 46 of the Code: "For the indication of the name of a group to be accurate and complete, and in order that the date may be readily verified, it is necessary to cite the author who first published the name in question."

We next turn to Article 27: "Names of species are binary combinations consisting of the name of the genus followed by a single specific epithet." *Tomanthera auriculata* seems to meet this requirement perfectly; it is complete. I look again at the book at my left and observe that I have copied the name accurately. My spelling and capitalization are precisely that of the printed page. I have achieved completeness and accuracy without the citation of either Michaux or Rafinesque.

There is another stated purpose of the author-citation: "in order that the date may be readily verified." Both Michaux and Rafinesque published in the first half of the preceding century, but that does not tell me any exact date. In fact, no date has been given me which I should verify. Rafinesque published over a series of years and in many different places. The citation gives me no clue whatever as to either place or date. What date am I to verify and how can I verify it from the mere mention of two botanists' names?

If I wish to find the date of publication, I turn conveniently to the Index Kewensis. There I find, under *Tomanthera auriculata*, a reference to New Flora of America, by Rafinesque, and in that book I find another reference to *Gerardia auriculata* Michx. For the latter, the Index Kewensis again gives me a reference to Flora Boreali-Americana. From the title pages of these two works I learn supposed dates of publication, but experience has taught me that title-page dates are not always

correct. I find some solace, however, in Article 45 of the Code, which tells me that these dates must be regarded as correct "in the absence of proof to the contrary."

In short, the only functions of author-citations which are stated in the Code are not achieved by citation of these two names. Completeness is already obvious; accuracy and dates are determined only by consulting the original publications. As a fulfillment of the stated purposes, the citations are a failure.

There is still another feature of Article 46 of the Code in its phrase: "the author who first published the name in question." In *Tomanthera auriculata* we do learn from the author-citation that it was Rafinesque; Michaux had nothing to do with "the name in question." Additional parenthetical citation of Michaux is required by Article 49 of the Code. And why is the name "in question"? It seems to me to be a perfectly valid name. There might be a question about the validity of the species to which the name is attached, and there is a question whether the species should be segregated from *Gerardia*, but the name itself seems to be beyond reproach.

I have quoted verbatim from the Code and trust that I have demonstrated that the only functions of citations which are mentioned by the Code are not fulfilled by them. There is one important use not mentioned in the Code: an author-citation is the most convenient way of distinguishing between homonyms. If the reader knows the period during which the cited authors worked, he may be able to distinguish the later homonym from the earlier. This may be useful in monographic works, where the accuracy of the author's opinion is subject to check by the reader, but in such works full citations to page and date are commonly given. In manuals and other general works, where plant names are merely being *used*, homonyms need not appear, being invalid.

Notwithstanding my cavil, there must be some good in author-citations, otherwise they would not have been used so generally and for such a long time. If one looks into the subject, he will soon find that they are a source of bits of information which vary from one citation to another. He will also find that their significance and apparently their purpose has gradually changed during the past two centuries.

Can a citation ever indicate the discoverer of the plant and

nothing more? I know of one example in particular which I shall not mention, in which the discoverer, whose name is permanently attached to the specific epithet as its author, has personally disclaimed any responsibility for the species, which he does not believe to be "good."

Can it ever indicate the person who merely suggested the name? Yes, many examples of this can be found and at least two are mentioned in the Code under Article 48. Spruce was a bryologist; his extensive Amazonian collections of flowering plants were studied, described, and published by Bentham and Hooker. It is probable that Spruce had no part in the launching of *Hevetia flexilis* (see the Code) except to suggest the specific epithet, which he had possibly done on his field label.

Can it ever indicate the person who is responsible for an opinion on the taxonomic status of the plant? Such is the case whenever a specific or subspecific taxon is changed in rank or transferred to a different genus. Thus in *Setiscapella cleistogama* (Gray) Barnhart, the citation shows that Barnhart's opinion on the classification of this plant differed from that of Gray, but does not show what or how great the difference was. This is brought out only by citation of the basonym *Utricularia subulata* var. *cleistogama* Gray and we still do not know why *Setiscapella* was used instead of *Utricularia*.

Can it indicate a person who merely published the new binomial under his own authorship, but did not recognize the species as unnamed, or suggest the name, or compile the description? I believe that such citations exist and that some of them emanated from my former institution, but it would be difficult or impossible to prove one of them at the present time.

Can a citation ever indicate merely vanity on the part of the author? My plant name and its citations must be fictitious, since I do not wish to malign a living botanist, but when *Pyrus Malus* α *americana* DC. is changed to *Pyrus Malus* var. *americana* (DC.) J. Doe, I can attribute such action and citation only to the personal vanity of Mr. Doe.

And lastly, can a citation ever indicate a person who merely played with names of plants and rules of nomenclature, possibly without knowing the plants or even seeing specimens of them? Unfortunately yes, and there are hundreds or probably thousands

of instances in which the citation, wholly or in part, merely indicates the name of a nomenclaturist.

The meaning of author-citations two centuries ago is easily ascertained by turning to almost any book of the time. We recall that botanical periodicals were then non-existent, that transactions of learned societies were few, and that almost all botanical publication was effected by books. A single author produced relatively few books in the course of his life. As time went on, it became customary for authors to deliver even small papers to the public, sometimes as small books, sometimes as articles in periodicals or transactions of societies. This tendency has become steadily more pronounced until today most taxonomic books are compendia or compilations or texts for students, produced of course after long and patient study and much careful research, while the description of "new" species and monographic studies of genera and families are mostly published in some sort of a serial.

Author-citations did not occur in the works of Linnaeus. Such citations as he gave were purely bibliographical and (in the Species Plantarum, at least) referred to other literature where the same kind of plant was discussed and where additional information about it could be had. The names of authors belonged *not with the plant but with the books* of which they were the authors. This same function continued in various works for more than a century, but tended to disappear as the number of useful works of reference increased. One of its last expressions is in Sargent's Silva of North America. Under *Ulmus americana*, for example, there is reference not only to Linnaeus but to forty-five other works where the plant is treated under this name and to several where it is also described under a different name. To be sure, the Linnaean citation is placed first and provided with a date, while all the others follow in roughly chronological order. At the top of the page appears the title, *Ulmus americana*, without an author-citation. In his preface Sargent states that he uses the first specific name published (back to 1753). The multiple citations therefore convey to the reader the idea that Sargent is using for the Elm a name published in 1753 and is using it in the same sense as it was used in forty-five other places.

A second meaning for the citation also came into use early, appearing first in the Systema Vegetabilium as revised by Johann Andreas Murray in 1798, in which he appended the initial M to the species proposed by himself: "idque non vanae ambitionis cause, sed ut ne errores, qui mei forsitan sint, Linneo tribuantur." (That the errors which I may have made will not be attributed to Linnaeus.) This introduces the idea of responsibility into the citation. The cited author is the one who recognizes a taxonomic entity and champions his opinion by proposing a name for it. He may not have been the first to recognize the entity: in the example given above it was Gray who recognized a certain Bladderwort and published it as a variety, but it was Barnhart who assumed the responsibility for its specific status; Torrey recognized *Pachystima Canbyi* as an undescribed species, but Gray is the responsible author. It was Bicknell who got the "credit" for distinguishing two species of *Scrophularia* instead of one, but it was also Bicknell who took the blame for proposing the specific epithet *leporella* when Pursh had long before named the plant *lanceolata*.

Here then we have two useful functions of the author-citation, the first a hint as to the place in literature where the first description of the plant may be found, the second a definite identification of the responsible botanist.

The first of these uses had at one time considerable value. As the number of taxonomists and taxonomic publications has increased during two centuries, as taxonomists have departed more and more from the old habit of publishing comparatively few books to the newer fashion of writing many short papers, this function has gradually lapsed. If one sees in literature the name *Teucrium charidemi* Sandwith apud Lacaita (example cited in the Code), where does he go about finding a description of the plant? You know perfectly well, it is through the Index Kewensis. As a source of bibliographic information modern citations are worthless. We still use and shall doubtless continue to use certain author-citations which have a purely bibliographic value. Kunth is certainly responsible for the vast majority of the numerous species ordinarily cited to Humboldt, Bonpland, and Kunth under the abbreviation HBK. L.-C. Richard is responsible for the new names appearing in Michaux' Flora Boreali-Americana, although they are cited to Michx.

The second use has always been of great value. It is desirable to know what the authority (not always the author) is behind the name. Certainly a species of fern vouched for by Maxon, or a *Eucalyptus* by Maiden, or a *Mesembryanthemum* by Brown, deserves our careful consideration before it is rejected as a mere synonym. But this desire is not always anwered by a citation, because the cited author may be responsible only for the name and scarcely or not at all for any taxonomic opinion about the plant. In other words, we can not distinguish a citation of taxonomic value from one of merely nomenclatural interest.

Nor does a citation always serve the "purposes of precision" demanded by the International Code. *Acer saccharinum*, *Quercus rubra*, and *Quercus Prinus* are all common trees of the eastern states and all were originally named by Linnaeus. Neither with nor without the appended citation L. does the reader have any idea to what kind of tree these three names refer, unless he knows the approximate date when the name was used and the disposition of the man who used it.

How much more sensible it is for persons who merely use scientific names of plants to follow the plan often seen in ecological papers and to state, in effect, that the names which they use are those used in Gray's Manual, or Britton & Brown, or Small's Manual, or what you will. What they mean by such a statement is, if expanded, that they have identified their plants to the best of their ability with the taxa described in the cited work of reference and assume no responsibility for the nomenclatural or taxonomic accuracy of the names. What more can any of us do?—GREENWICH, CONNECTICUT.

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## ILLEGITIMACY OF PERSOON'S SPECIES OF KOELERIA (GRAMINEAE)

LLOYD H. SHINNERS

IN his *Synopsis Plantarum*, vol. 1, p. 97, 1805, Persoon described the genus *Koeleria*, with five species. Four of the five names are unequivocally illegitimate, since an earlier, legitimate epithet in the same rank is cited as synonym, but not taken up. The fifth (no. 3, *tuberosa*) is for all practical purposes illegitimate also, since the synonym quoted by Persoon with question mark does in fact apply to the same plant. The nomenclature has

been only partially clarified in Karl Domin's *Monographie der Gattung Koeleria* (Bibl. Bot. 65, 1907), with an elaborate array of infraspecific taxa which creates more problems than are solved. The five original species may be discussed in the order named by Persoon.

1. K. GRACILIS Pers. "Poa nitida. Lam. ill. 1. p. 182. Poa cristata. Krocker. sil. ic. An Aira subspicata. L.?" The oldest legitimate epithet is that of Lamarck, 1791. It cannot now be transferred to *Koeleria* because of *K. nitida* Nutt., 1818. If considered distinct from the next species, as is done by Domin and other European writers, it must be called *K. macrantha* (Ledeb.) Spreng., Mant. **2:** 345–346, 1824. This is apparently the correct designation for the plant currently known in America as *Koeleria cristata*, and in Europe as *K. gracilis*. It is not mentioned in Domin's *Monographie*, but appears as synonym of *K. gracilis* in Hegi's *Illustrierte Flora von Mittel-Europa* **1:** 286, 1908 (text for this genus supplied by Domin), in its original form, *Aira macrantha* Ledeb.

2. K. CRISTATA Pers. This must be considered a new name as published by Persoon, since he does not indicate a particular synonym, but says merely "Poa cristata auctorum." De Candolle (Cat. Pl. Hort. Bot. Monsp., p. 116, 1813) and many subsequent authors (recently Hitchcock, Man. Grasses U. S., ed. 1, p. 873, 1935; ed. 2, p. 887, 1950) have supplied *Poa cristata* (L.) L., or *Aira cristata* L., as basinym. This is not correct, because Persoon himself cited *Poa cristata* L. as synonym, not of *K. cristata*, but of species no. 4, *K. phleoides*. Three varieties are listed under *K. cristata*, of which the second and third are based respectively on *Poa pectinata* Lam. and *P. pyramidata* Lam. The former, according to Domin and recent European authors, belongs to *K. vallesiana* (for nomenclature of that species, see under no. 3). Lamarck's other species provides the earliest available epithet, and the legitimate name for *Koeleria cristata* Pers. (not of most later authors) is therefore *K. pyramidata* (Lam.) Beauv., Agrost., pp. 84, 166, and 175, 1812. It is worth quoting Lamarck's description, from Ill. **1:** 183, 1791: "P. panicula pyramidali, glumis laevibus nitidis muticis trifloris, vaginis villoso-pubescentibus. . . . *Cult. in H. R. a p. cristata distinctiss. spec.*" Domin restricts this species to central and western Europe.

3. K. TUBEROSA Pers. "Aira valesiaca Allioni? Aira cristata. Smith. brit. l. p. 83." Under this species is named var. *? setacea.* The description and reference to Smith constitute valid publication, if the doubtful reference to Allioni is disregarded. But *Aira valesiana* All., Fl. Pedem. Auctarium, p. 40, 1789 (with reference to Haller and Scheuchzer), redescribed several times by other authors with various spellings of the same epithet, is evidently the same as *K. tuberosa.* The oldest synonym reported by Domin is *Festuca splendens* Pourret, 1788, basinym for *Koeleria splendens* (Pourr.) Druce, 1905. The latter is however a later homonym of *K. splendens* Presl, 1820, The next oldest synonym is *Poa pectinata* Lam., Ill. **1:** 182, 1791, with an epithet not previously employed in *Koeleria.* The name of this species must therefore become **Koeleria pectinata** (Lam.) Shinners, comb. nov., based on *Poa pectinata* Lam., l. c. The plant appears in recent European works as *K. vallesiana* (Honckeny) Bertol. ex R. & S., Mant. **2:** 346, 1824. This is incorrect for several reasons. Roemer & Schultes introduce Bertoloni's binomial with the words "adde synonymon," so that it was not validly published in 1824. The binomial derives from Allioni's *Aira valesiana,* 1789 (the same spelling is used, and Allioni is mentioned), not from Honckeny's *Poa vallesiana,* 1782. The spellings *vallesiana, valesiana, vallesiaca, valesiaca* must be regarded as merely orthographic variants of the same name. *Koeleria valesiaca* (Suter) Gaudin, 1808, prevents the adoption of any later combinations based on such epithets. Consequently neither *Aira valesiana* All. nor *Poa vallesiana* Honck. can serve as basinym for a legitimate combination under *Koeleria.*

4. K. PHLEOIDES Pers. "Festuca. Villars. Dauph. 2. p. 95. Avena pumila. Lam.? videtur. Poa *cristata.* Linnaei." The earliest epithet, that of Linnaeus, should have been kept. Failure to adopt it makes the combination *K. phleoides* illegitimate. Though Persoon's citation typifies the Linnaean species by the element known as *K. phleoides,* his publication of *K. cristata* as a different and newly designated species prevents the adoption of the proper Linnaean epithet for *K. phleoides.* Since the name *K. phleoides* (Vill.) Pers. is illegitimate, the plant must be called **Koeleria Gerardi** (Vill.) Shinners, comb. nov., based on *Festuca Gerardi* Villars, Hist. Pl. Dauph. **1:** 249, 1786 (in footnote),

a species not listed in Index Kewensis. *Koeleria Gerrardi* Benth. & Hook., Gen. Pl. 3: 1184 and 1194, 1883 (spelled *Gerardi* on p. 1184, *Gerrardi* on p. 1194 and in Index Kewensis) is a *nomen subnudum*. I have followed Stapf, in Thiselton-Dyer, Fl. Cap. **7:** 697, 1900, in treating it as a *nomen nudum* (listed by Stapf as synonym of *Stiburus alopecuroides* (Hack.) Stapf, spelled *Gerrardi*, with the remark "name only"). It can also be held that *Gerardi* and *Gerrardi* are entirely different epithets for nomenclatural purposes because taken from names of different persons with different spellings, even though the difference is of one letter only. An older name, *Alopecurus ciliatus* All., 1785, is unavailable for transfer because of *Koeleria ciliata* Kerner in Baenitz, 1879 (or ex Domin, 1903), and *K. ciliata* Aschers. & Graebn., 1900. If treated in the segregate genus *Lophochloa*, the correct name of this species is *L. cristata* (L.) Hylander, Bot. Notiser **1953:** 355, based on *Festuca cristata* L., 1753, not on *Aira cristata* L., 1753, which happens to be the same plant. I personally do not favor the degree of splintering of genera found in publications by Nevsky and other recent European authors; *Lophochloa* can quite satisfactorily be considered a good subgenus under *Koeleria*.

5. K. VILLOSA Pers. "Phalaris pubescens. Poiret. Aira pubescens. Vahl, symb. 3. p. 9. Desf. Atl. 2. p. 446." *Koeleria pubescens* Beauv., Agrost. pp. 85 and 166, 1812, was a *nomen nudum* (according to Niles, Contrib. U. S. Nat. Herb. **24:** 188, 1925), but it was later validated by Cosson & Durieu, and subsequently by other authors with confused author citations. The basinym is *Phalaris pubescens* Lam., Encycl. Méth. Bot. **1:** 92, 1783. Vahl lists *Phalaris pubescens* "Poir." as synonym of his *Aira pubescens*, but neither in the introduction to volume 1 of the Encyclopédie nor under the special article Alpiste (*Phalaris*) is Poiret mentioned. The full citation of the correct name then must be *Koeleria pubescens* (Lam.) Beauv. ex Cosson & Durieu, Fl. Alg. II. p. 122, 1854–1867 (this reference not seen). The combination appears in Boissier, Fl. Or. 5 pt. **2:** 573–574, 1884, with erroneous author citations, but with the same ultimate basinym.—SOUTHERN METHODIST UNIVERSITY.

# THE HYBRID ORIGIN OF HELIANTHUS DORONICOIDES

R. C. Jackson[1]

*Helianthus doronicoides* was named and described by Lamarck in 1789 from a specimen under cultivation in the Jardin du Roi. Lamarck believed that the original material had come from North America. The type specimen is deposited in the Muséum National d'Histoire Naturelle in Paris, France. A photograph of the type specimen (Plate 1225) has been studied and supplemental information has been kindly supplied by Dr. Arthur Cronquist who has examined the type.

In nature *H. doronicoides* appears to be extremely rare. Watson (1929) lists several specimens which he considered to be *H. doronicoides*, but he never found this species in his extensive collecting of the genus. Deam (1940) concluded that the species was one of the rarest sunflowers in Indiana. He once collected it growing naturally in Marshall County and transplanted a part of the clone to his garden in Bluffton, Indiana.

A study of herbarium collections of *H. doronicoides* has shown that, for the most part, specimens designated as this species are fragments of other perennial taxa of *Helianthus*. Commonly, the upper portion of *H. tuberosus* L. and *H. strumosus* L. have been labeled *H. doronicoides*. Cronquist (private communication) has previously found miscellaneous collections of misfits under the name *H. doronicoides* in several herbaria, and has omitted this species from Gleason's Flora.

The rarity of *H. doronicoides* in nature has led to the suspicion that it is, perhaps, of hybrid origin. Morphologically the species appears closest to *H. mollis* Lam. Both species have sessile leaves, and the two main lateral veins diverge from the midrib some distance from the leaf base. However, the phyllary shape, general pubescence, and height of the two species are somewhat different. Watson (1929) has suggested that *H. mollis* and *H. tomentosus* Michx. are the two closest relatives of *H. doronicoides*.

[1] The writer wishes to express his thanks to Dr. C. B. Heiser, Jr., Indiana University, who suggested this problem, and to the curators of herbaria who have loaned specimens for study.

An attempt to relocate the clone of *H. doronicoides* from which Deam made his collection was unsuccessful. In the same county, however, several populations of putative hybrids between *H. mollis* and *H. giganteus* L. were found. Among these hybrids were a number of plants fitting the description of *H. doronicoides*. Some of the hybrids were possibly back-crosses, but generally there was little morphological variation from one population to another. In Indiana the two parental species are ecologically separated. *Helianthus giganteus* is found in decidedly wet habitats along streams, in old lake beds, and in wet prairie. On the other hand, *H. mollis* usually occurs in drier sites along fence-rows, railroad right-of-ways, on low sand ridges, and prairie areas. Where the two species occupy adjacent and disturbed habitats hybrids have been found. Deam's specimen of *H. doronicoides* was collected along an open ditch through a cleared field.

A program of artificial hybridization and cytological study was initiated in order to synthesize *H. doronicoides* and to determine its affinities with those species to which it appeared to be more closely related morphologically. Seeds of *H. doronicoides* had previously been obtained from Deam, and this species along with *H. mollis*, *H. giganteus*, and *H. tomentosus* was grown in the Experimental Garden at Indiana University. Cytological examination of the species revealed that *H. tomentosus* was hexaploid with $n = 51$. *Helianthus mollis* and *H. doronicoides* were both diploid with $n = 17$. The chromosome number of *H. giganteus* was $n = 17$ as reported by Geisler (1931). *Helianthus doronicoides* was found to have 68 per cent stainable pollen while in the other species the pollen was approximately 100 per cent stainable.

Hybrids between *H. mollis* and *H. doronicoides*, *H. mollis* and *H. giganteus*, *H. doronicoides* and *H. giganteus* were obtained. All crosses of these species to *H. tomentosus* were unsuccessful. In the cross of *H. doronicoides* to *H. mollis* and *H. giganteus* there was an increase in the fertility of the few hybrids obtained over that found for *H. doronicoides*. Meiosis in the progeny appeared to be normal, and they were morphologically intermediate for the parental characters. The $F_1$ hybrid between *H. mollis* and *H. giganteus* was somewhat intermediate for

Helianthus doronicoides Lam.
Type
Helianthus doronicoides Lam.
dict

characters of the two parents, but it resembled *H. giganteus* more closely in leaf and phyllary shape. Phyllary length of the hybrid exceeded that of either parent. In comparison with the type of *H. doronicoides*, the leaves of the $F_1$ were narrower and less pubescent. However, among the progeny of a backcross to *H. mollis* there were a number of plants which were morphologically very close to the type of *H. doronicoides*. Other progeny of the backcross exhibited a series of character gradations between the $F_1$ and the recurrent parent.

Meiosis was studied in the hybrid between *H. mollis* and *H. giganteus*. Seventeen bivalents were found in 50 microsporocytes studied at diakinesis. At first metaphase fragments were found in 28 of 50 cells examined. A single chromatin bridge was observed in a few cells at first anaphase. The hybrid yielded 57.9 per cent stainable pollen. Inasmuch as bridges were not found in either of the two parental species, it is quite possible they differ for at least one inversion.

All available evidence indicates that *H. doronicoides* is of hybrid origin, and that this species epithet was applied to a hybrid derivative from a natural cross between *Helianthus mollis* and *H. giganteus*. According to the International Code of Botanical Nomenclature a putative hybrid between two species of the same genus may be designated by a formula or by a name. Since the epithet *H. doronicoides* has been in the literature for some time, it is retained here under a new status.

**Helianthus** × **doronicoides** Lamarck (pro sp.)

*Helianthus doronicoides* Lam. Encyc. **3:** 84. 1789.

SPECIMENS EXAMINED: NEW JERSEY. Atlantic County: Sept. 14, 1896, *C. A. Gross* (ILLS). INDIANA. Marshall County: along an open ditch through a cleared field, Sept. 21, 1930, *Deam 49921* (IND). Starke County: along a highway drainage ditch, Sept. 1, 1953, *Jackson 706–10* (IND); on excavation of a newly dug drainage ditch, Aug. 29, 1954, *Jackson 710–25* (IND). Sullivan County: 4 miles west of Shelburn, Aug. 24, 1912, *Deam 12156* (IND). ILLINOIS. Sangamon County, Barrens, Spring Creek, Sept. 1860, *E. Hall* (F).

Although a number of hybrid populations were located, observations over a two year period indicated that they were not competing successfully with the parental and other species in the disturbed habitats. Three small populations seen in 1953 were not found in 1954, and some of the larger populations were

reduced in the number of clones present the second year. It appears that the hybrids may be able to survive only in disturbed habitats in an early successional stage and that they are later eliminated by other species. Nevertheless, it may be expected that the hybrid will continue to occur wherever the habitats of *H. mollis* and *H. giganteus* are adjacent and disturbed.—DEPARTMENT OF BIOLOGY, UNIVERSITY OF NEW MEXICO.

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# SOME CHROMOSOME NUMBERS IN THE GENUS CALLIRHOË (MALVACEAE)

W. H. P. Emery

The genus *Callirhoë* is represented in Texas by six of its seven species (Waterfall, 1951). One of these Texas species, *C. involucrata*, has three recognized infraspecific taxa; a second species, *C. digitata*, has two. Waterfall in treating this genus emphasized the extreme morphological variation of one variety—var. *lineariloba*. He listed several morphological tendencies of the group but concluded that due to the intergradation of characters it did not seem feasible to circumscribe further infraspecific taxa.

In view of the synonymy, Waterfall's comments, and personal observations on the variability of this species, I have referred to it as the *C. involucrata* "complex."

Previously, only two chromosome counts have been reported for *Callirhoë*. Kesseler (1932) reported a number of $n = 12$ from meiotic figures of *C. involucrata*. Skovsted (1935) reported a number of $2n = 42$ for mitotic figures in the root tip cells of *C. lineariloba* Gray (= *C. involucrata* var. *lineariloba*).

## Materials and Methods

Chromosome counts were made from acetocarmine and aceto-orcein anther smears following fixation in a 1 glacial acetic acid: 3 absolute alcohol solution.

Attempts to obtain smears from fresh material were not successful because "druses" of oxalic acid from the anthers prevented proper flattening of the preparations. Following fixation, however, this difficulty was not encountered.

Voucher specimens of each collection have been deposited in the University of Texas Herbarium, Austin, Texas. Grateful acknowledgement is made to Dr. B. C. Tharp for his help in procuring some of the collections noted here. In the following table are listed the source and chromosome numbers of the material examined. Nomenclature and identification follow the treatment of Waterfall.

| SPECIES | SOURCE AND VOUCHER NUMBER | *n* |
|---|---|---|
| ******C. involucrata* (T. & G.) Gray var. *involucrata* | Texas: according to B. L. Turner from Polk Co. *W. H. Emery 100.* | 42 |
| ******C. involucrata* var. *lineariloba* (T. & G.) Gray | Williamson Co.: Cedar Park, Tex. *W. H. Emery 99.* | 14 |
| ——————— | Gonzales Co.: Palmetto State Park. *W. H. Emery 98.* | 28 |
| *——————— | Travis Co.: Austin, Tex. *W. H. Emery 97.* | 30 |
| *——————— | Texas: locality unknown Buds from garden material. *W. H. Emery 96.* | 34–35 |
| ******C. digitata* Nutt. var. *stipulata* Waterfall | Travis Co.: Austin, Tex. *W. H. Emery 95.* | 14 |
| *C. digitata* var. *stipulata* forma *alba* Waterfall | Williamson Co.: Cedar Park, Tex. *W. H. Emery 94.* | 14 |

*** Camera lucida drawings of meiotic division figure attached to voucher specimen.**

## Discussion

From a preliminary cytological survey of this group it is evident that the genus *Callirhoë* is composed of a polyploid series which is interpreted to have a base number $n = 7$. Of the six collections of the *C. involucrata* "complex" for which chromosome counts have been made, no two have the same number. Four plants are considered euploid, while the remaining two ($2n = 24$, Kesseler; $2n = 60$, reported above) are

considered aneuploid. Despite the fact that both of these numbers are multiples of six, it is unlikely that within the "complex" there are two polyploid series, one based on seven and one based on six. From the chromosome numbers reported above it is obvious that the extreme morphological variability in *Callirhoë* noted by Waterfall is paralleled by an equally great variation in chromosome numbers.

No attempt was made by the present writer to determine any possible correlation between chromosome numbers and morphological types. The limited chromosomal information presented here suggests that correlated cytological and field studies are desirable in further attempts to delimit the heterogeneous morphological taxa represented by *C. involucrata*.—THE PLANT RESEARCH INSTITUTE, THE UNIVERSITY OF TEXAS, AUSTIN, TEXAS.

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# Rhodora

JOURNAL OF

THE NEW ENGLAND BOTANICAL CLUB

**Vol. 58** **May, 1956** **No. 689**


## VARIATION IN POLEMONIUM REPTANS


E. Lucy Braun[1]


*Polemonium reptans* L. varies as to height and habit of branching, number and shape of leaflets, size of corolla, shape of sepals, and density, length, and nature of pubescence. Two taxa within the complex should be distinguished—var. *reptans* and var. *villosum*—which in this paper will be referred to as *reptans* and *villosum*. The former is more variable than the latter. The writer believes that the variability of *reptans* is due to introgression, that the introgressant is the more stable *villosum;* variation within *villosum* may be coming from introgression from *reptans*.

In 1940, *villosum* was described as a variety of *P. reptans* (Braun, 1940). In 1942, Wherry reduced this to forma *villosum*, claiming that plants of this character "may appear almost everywhere over the range" (Wherry, 1942). In 1950, Davidson, in his monograph on the genus *Polemonium*, reduced *villosum* to synonymy with *P. reptans*, because he grew plants from seed of "glabrous and pubescent forms" furnished by Wherry (presumably from Pennsylvania), and found that "the plants grown from the two lots of seed were all quite glabrous, and the advisability of according taxonomic recognition to such an evanescent character is considered doubtful, even in the category of 'forma'" (Davidson, 1950).

Unfortunately, Davidson obtained no seed of the glandular-villous *villosum* from the geographic area whence it had been


[1] The writer expresses thanks to Dr. Edgar Anderson for his encouragement and helpful suggestions during the progress of this study, and to Dr. Richard P. Goldthwait for glacial boundaries on the map.

reported. Examination of all material in the Gray Herbarium previous to setting up this "variety" revealed no specimens comparable to it. Subsequent examination of specimens in the herbarium of the Missouri Botanical Garden, the Ohio State University, the University of Pennsylvania, and the herbarium of E. T. Wherry has further demonstrated that typical *villosum* is represented only by specimens from a limited geographic area —Adams, Highland, Pike, and Scioto counties, Ohio, and Lewis County, Kentucky. Ten of the 70 specimens in the Ohio State Herbarium are *villosum*, all from Adams and Scioto counties.

That *villosum* comes true from seed is amply demonstrated by the large pure populations occurring in its restricted range—populations of hundreds of plants. It comes true from seed in the writer's woodland. All colonies occur near the western border of the Unglaciated Allegheny Plateau (Fig. 1), an area which has had a long and complicated physiographic and climatic history, an area known for the occurrence of disjuncts, and of species at margin of their range (Braun, 1928, 1951; Thomas, 1951; Wolfe, 1951). Before discussing the possible history of *villosum* and *reptans*, the characters of the two taxa will be contrasted; consideration of intermediate or intergrading forms will follow. Mass collecting or population sampling methods have been used.

The "Manual" descriptions of *Polemonium reptans* (and Davidson's also) doubtless include the intermediate forms, which here are ommitted from the discussion of *reptans;* they do not include *villosum*.

The most constant diagnostic character of *villosum* is the densely glandular-villous inflorescence, in contrast to the "minutely puberulent" (Gleason, 1952) inflorescence of *reptans* (Fig. 2). The glandular hairs are multicellular, 0.5 to 1.0 mm. or more in length, and taper from base to glandular summit (Fig. 2E). In life, these glandular hairs may be seen without the aid of a lens, because of the conspicuous glistening glandular secretion present.

Stems and leaves of *villosum* are glandular-villous, but less densely so than the pedicels, except near the nodes. Glandular stem-hairs are often 1–2 mm. in length (Fig. 2C). The stems are not lustrous as are those of *reptans*. Hairs of the leaf rachis

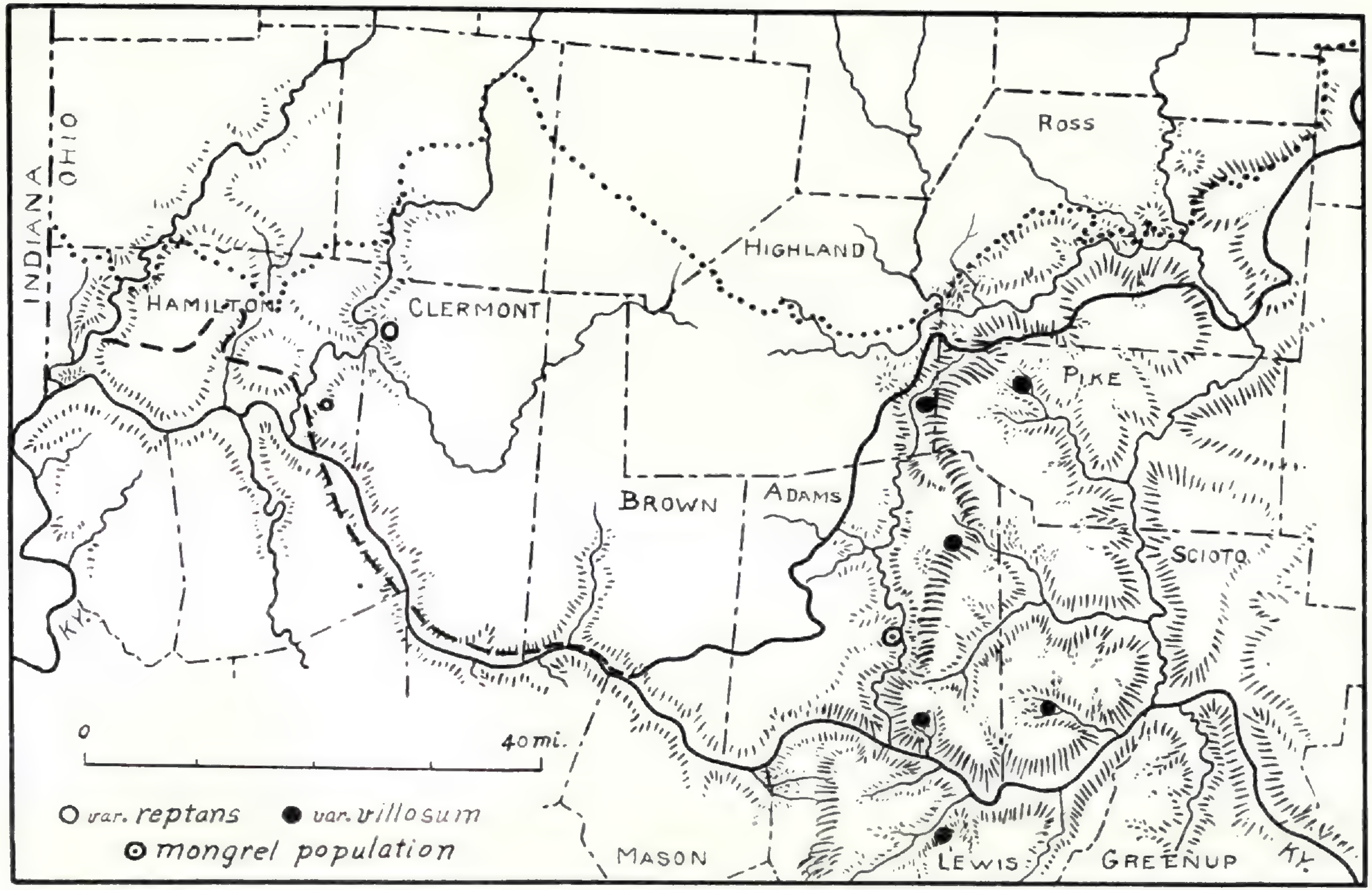


FIG. 1. Map of southwestern Ohio and adjacent Kentucky showing location of populations of *Polemonium reptans* L. studied; the larger circles indicate populations used in graphs. The higher and more rugged Allegheny Plateau is to the east, its western escarpment indicated by stronger hachures. The limit of Illinoian glaciation is shown by heavy full line (extending from upper right to Ohio River) and broken line (where less definitely known); limit of Wisconsin glaciation by dotted line. Glacial boundaries furnished by R. P. Goldthwait and (broken line) by J. Forsyth.

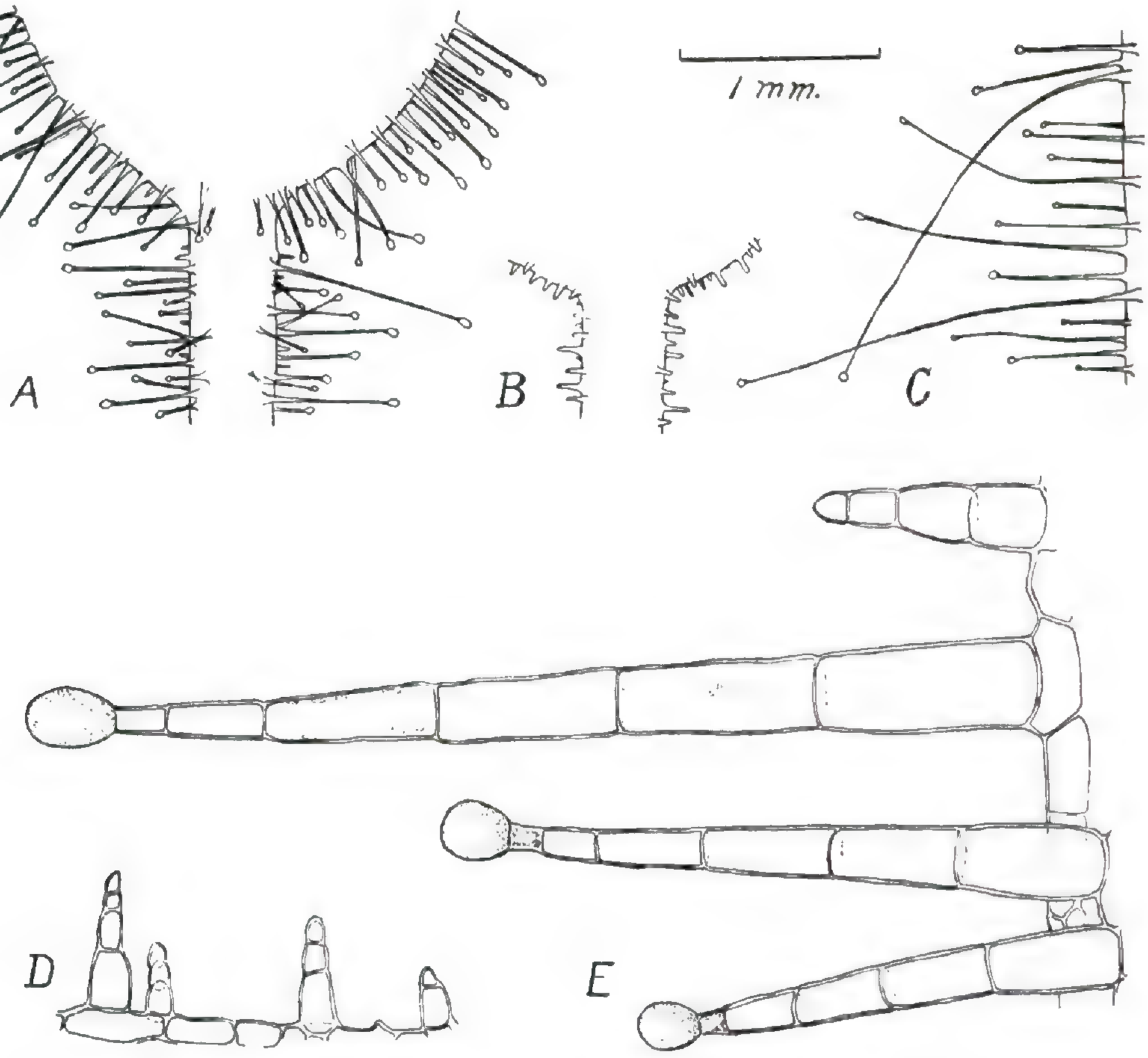


Fig. 2. Calyx, pedicel, and stem pubescence of *P. reptans* var. *reptans* and *P. reptans* var. *villosum:* A. Pedicel and lower part of calyx of *villosum;* B. Pedicel and lower part of calyx of *reptans;* C. Stem of *villosum,* just above lowest cauline leaf (A, B, and C in optical section; 1 mm. line shows scale); D. Greatly magnified pedicel hairs of *reptans* and E, of *villosum.* All drawn from living material.

are similar. Plants of *villosum* are so viscid that bits of humus and other foreign matter, and small insects are seen adhering to stems and pedicels. These help to give herbarium specimens of *villosum* their characteristic aspect. An odor of skunk, similar to that of certain western species of *Polemonium,* is noticeable if living plants have been enclosed, as when collecting in plastic bags, and, at times, when handled in the open.

In general, plants of *villosum* are lower than those of *reptans,* and the main stems diverge from one another at a wider angle.

Basal leaves of *villosum* tend to have fewer leaflets than those of *reptans.* The ratio of length to width of leaflets differs in the two. Leaflets of *reptans* are more than twice as long as wide; those of *villosum* mostly less than twice as long as wide (Figs. 3, 4). Differences in leaves in the inflorescence may be

less pronounced. Correlated with the broader and shorter leaflets of *villosum*, apical and basal angles are normally wider than those of *reptans* (Figs. 3, 4). Leaflets often are not "acute" as are those of *reptans*, the margins sometimes converging at angle of 105° or more, and often over 90° seldom less than 75°. Although the ranges of leaflet number and of length : width ratio overlap, populations of the two taxa are noticeably different in leaf aspect.

Flowers of *villosum* are smaller than those of *reptans*, 8–12 or rarely 13 mm. long, in contrast to 12–16 mm. long. The size differences of wide-open flowers (measured in the field) is more prominent: 11–17 mm. (av. 14 mm.) in diameter, as contrasted with 18–23 mm. (av. 19.5 mm.).

Many pedicels of *villosum* are shorter than the calyx, both in flower and fruit. The calyx lobes are shorter and broader, not "lanceolate to lance-triangular" (Fernald, 1950) as are those of *reptans*, but more deltoid, often almost an equilateral triangle in shape. The calyx of *villosum* is glandular-villous, especially toward base, and its margin glandular-ciliate (Fig. 2A).

In the field, *reptans* and *villosum* are so obviously different that they are readily distinguished. This has been emphasized more than once when the writer has been asked "what is the *Polemonium* in Adams County?" or told that one will not thrive under cultivation (as does *reptans*), or that "it is not worth growing, anyway." It is far less showy.

To demonstrate differences in pure populations of *reptans* and *villosum*, pictorialized scatter diagrams of the type devised by Anderson (1949, 1952, 1953) have been used (Fig. 4).

All parts of the plants of *villosum* are glandular-villous—pedicels and calyx, stems, and leaves. Such plants are represented on the pictorialized scatter diagram by solid dots, to contrast with the circles used for the essentially glabrous and non-glandular *reptans* (Fig. 4). Position of dots on this graph is based upon the ratio of length to width of median leaflets of cauline leaves, and upon pedicel-hair characters.

For the length : width ratio, the median pair of leaflets (or leaflets just below the middle, if number of pairs was even) of the lowest good cauline leaf were used. Cauline leaves near to the base of the stem and resembling basal leaves were rejected.

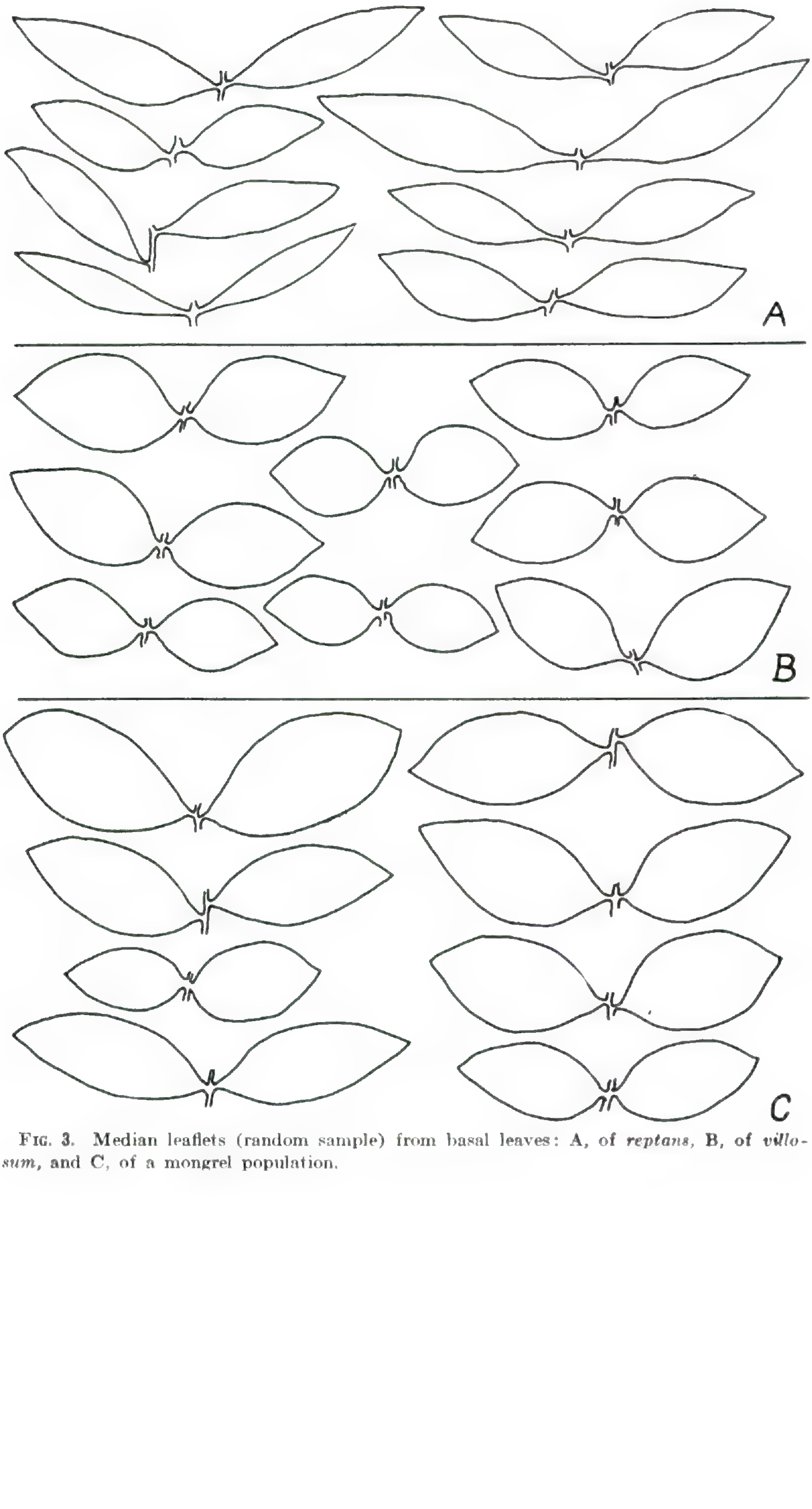


Fig. 3. Median leaflets (random sample) from basal leaves: A, of *reptans*, B, of *villosum*, and C, of a mongrel population.

The length and greatest width of both leaflets were measured, and the ratios obtained from the two leaflets averaged.

The pedicel score is based on length and character of hairs of the pedicel:

1. All hairs short and stubby, .05 mm. long; hairs short, but less blunt; or, occasional hairs to .2 mm. long scattered among short hairs.
2. Many hairs .25± mm., to some .3 mm.
3. Many hairs .3± mm. to some .4 mm.
4. Hairs .3, .5, and .7 mm., and also shorter hairs.
5. Many hairs .5 or .7 mm., some .8 or 1.0 mm., and also shorter hairs.

Hairs were measured by using an ocular scale ruled to half millimeters, using whole pedicels. Exact measurements on whole pedicels are not possible because hairs project at various angles. The use of smaller parts and higher magnification was impractical because of variation from place to place. Pedicels were scored in intermediate positions (as shown on the graph) in accordance with variations in length and dominance of particular lengths.

Characters used on the glyphs are ones which cannot be measured or scored as closely as can the length : width ratio or length and nature of pedicel hairs. Angles were measured by superimposing on the form to be measured paper sectors differing from one another by 15°, i.e., sectors 30°, 45°, 60°, 75°, 90°, 105°. Apical and basal leaf-angles often do not express the immediate tip or base of the leaflet, but rather the angle at which the margins converge toward apex or base. As margins are often slightly convex, the exact angle could not be measured.

Stem pubescence varies from base to inflorescence, and from internode to node. The three-score system used is:

1. Stems essentially glabrous, or with scattered hairs.
2. Hairs widely spaced on internodes, more closely placed near nodes or toward base of stem.
3. Hairs dense, or very dense, and long, some 1 mm. or sometimes 2 mm. long.

A three-score system was also used for leaves:

1. Leaves glabrous except for a few hairs in rachis groove or on petiole margin toward base, and except for a very small area of short hairs in concavity of base of midnerve of leaflets.
2. Rachis thinly pubescent, more densely so toward base.
3. Rachis villous; both leaf surfaces pubescent.

The complete separation on the diagram (Fig. 4) of glyphs representing flowering individuals of the *reptans* population from

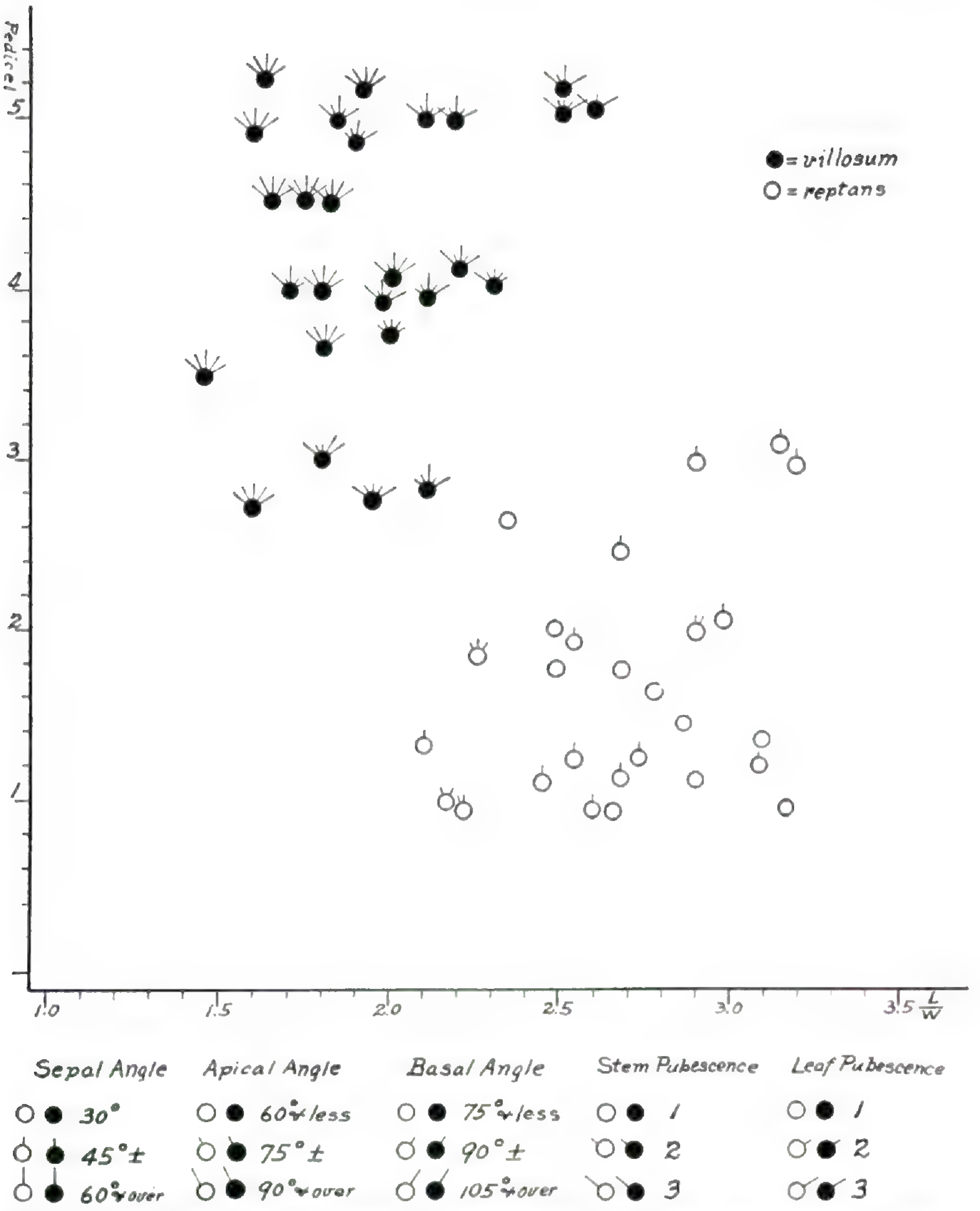


Fig. 4. Pictorialized scatter diagram of populations of *villosum* and *reptans*, based on characters of flowering plants collected in April. Horizontal axis: ratio of length to width of median leaflets of lowest good cauline leaf. Vertical axis: pedicel hairs, scored as described in text. Note complete separation of glyphs of the two populations.

those of the *villosum* population is evident. Almost as complete separation was seen on a diagram representing summer basal leaves, on which the glyphs were placed in relation to the length: width ratio and number of leaflets. Pubescence of leaf, and apical and basal angles were scored as in Fig. 4. Two entities were illustrated by these diagrams.

Some populations of *reptans* show slightly more variation than

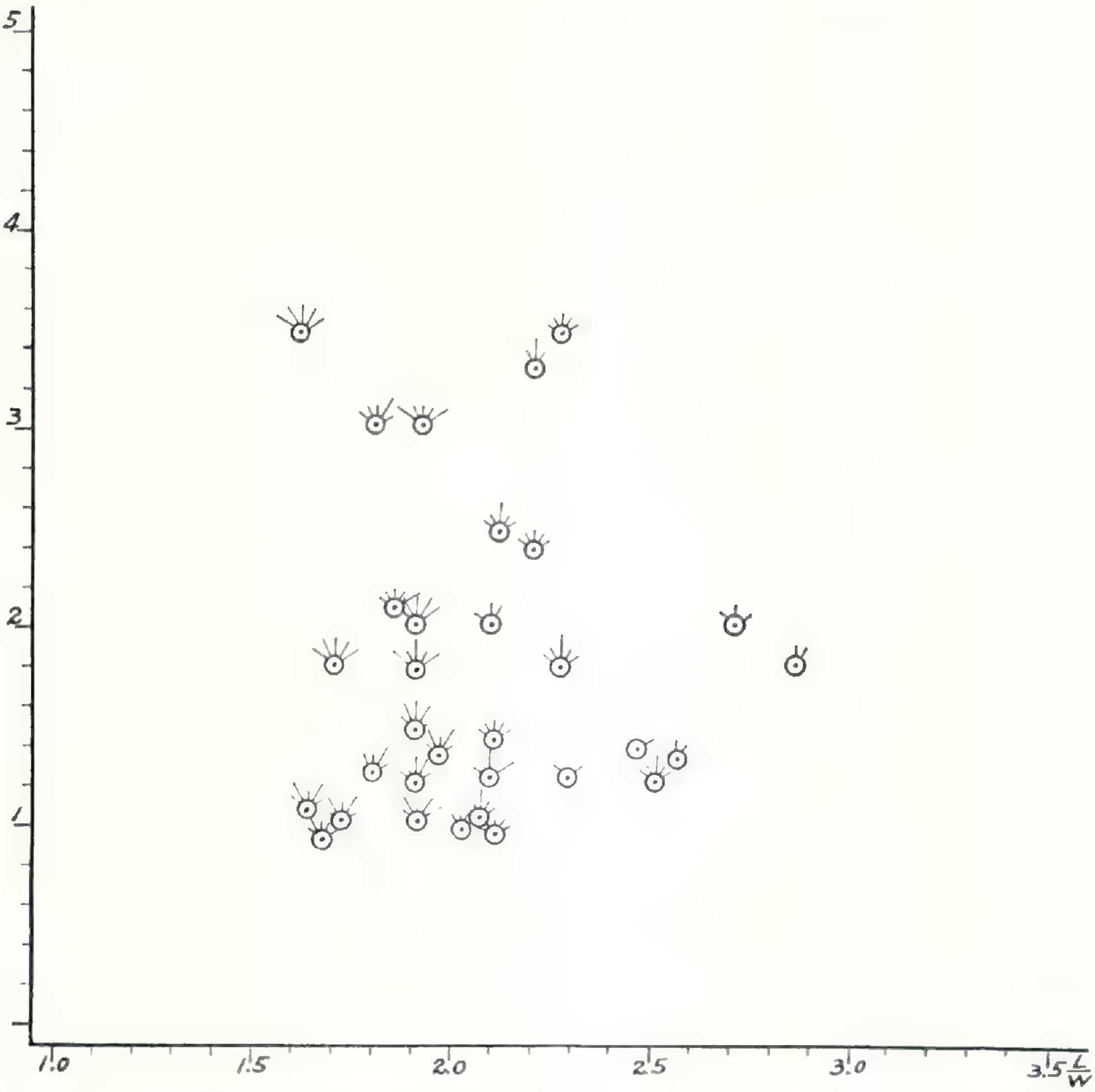


**Fig. 5. Pictorialized scatter diagram of mongrel population, based on characters of flowering plants collected in April. Axes and glyph appendages as in Fig. 4.**

the one illustrated by Fig. 4. Some herbarium specimens differ considerably from those of the population diagrammed, yet are obviously referable to *reptans*. What is the cause of this variation? Discovery of a mongrel population in which some plants resembled *reptans*, some resembled *villosum*, afforded an opportunity for analysis (Fig. 5). Open circles, with dot in center, are used in glyphs for this population, because such glands as may be present are inconspicuous and not evident under a 10× hand lens as are those of *villosum*. Although a few of the longer hairs are structurally similar to those of *villosum*, the gland appears to be non-functional and the conspicuous tip is absent. All glandular hairs deteriorate in summer, and it is not possible to distinguish functional and non-functional glands at this season.

Comparison of Figs. 4 and 5 shows that the glyphs in Fig. 5 are not distributed like those of either *reptans* or *villosum*, that some are in the area of *reptans* glyphs, some in the area of *villosum* glyphs, and some in a position not occupied by either, but in the belt of low length : width ratio as well as in the position of puberulent rather than villous pedicels. Furthermore, there is a tendency for those of higher length : width ratio to be simpler —more like pure *reptans*—while those of lower length : width ratio tend to have more of the *villosum* characters. Such a tendency is indicative of hybridization. Although many plants resemble *villosum* in length : width ratio and in amount of pubescence, none has the characteristic glandular-villous inflorescence of that taxon. This character appears to be recessive, and to be controlled by different genes than is stem pubescence.

Comparison of summer basal leaves of *villosum* and *reptans* populations with those of the mongrel population brings out similar although less marked differences. Number of leaflets is not as distinctive a character as is pedicel-hair character. Nevertheless, the tendency toward *villosum*-like plants in the area of *villosum* glyphs, and toward *reptans*-like plants in the area of *reptans* glyphs was present in scatter diagrams of the mongrel population.

A high degree of sterility of some plants may be further evidence of hybridization. Failure of capsule development and accompanying excessive enlargement of calyx was noted in several specimens among the random samples.

The "connection between hybridization and disturbed habitats" has been summarized by Anderson (1949). This mongrel population of *Polemonium* occupies an area where man has "hybridized the habitat," an area on a wooded slope steepened many years ago when a road was built in the valley at its base. Typical *reptans* may have grown in this valley; and perhaps typical *villosum* occupied some of the ravines. The nearest known pure populations of the latter are in other valleys some four to six miles distant in an air-line and separated by high hills which interpose ecologic barriers. Typical *reptans* is much more distant (Fig. 1). Anderson has stated "it is only where man or catastrophic natural forces have 'hybridized the habitat' that any appreciable number of segregates survives."

Hairiness of stem and leaf, and low length : width ratio are prominent in the mongrel population. Glandular-villous pedicels are almost absent. This is precisely what is seen when hundreds of herbarium specimens of *P. reptans* (inclusive) are examined. Some are pubescent, some have broader leaflets than others, some have the short, "squatty" form of *villosum*, but none has the glandular-villous pedicels.

Hybridization, such as is clearly indicated by the mongrel population analyzed, may have taken place infrequently in the past. Some characters have been lost, some retained, in the ensuing back-crosses. The results of introgressive hybridization are evident over a wide geographic area, but pure or almost pure *reptans* populations prevail. And large pure populations of *villosum* exist in a limited geographic area. Why have these not been swamped by the widespread *reptans?* This would seem likely if *villosum* had always been surrounded by *reptans*.

The suggestion is here made that *villosum* is older than *reptans*, that the now restricted range of *villosum* is a remnant of a former more extensive and perhaps more northern range; that at some time during the Pleistocene this range was decimated, leaving only those populations south of the immediate effects of ice sheets. The distribution of existing populations of *villosum* correlates well with the disjunct occurrences of a number of species generally interpreted as relic distribution. Biotype depletion is a usual accompaniment of restriction of range. The uniformity of populations of *villosum* and their failure to spread suggest such biotype depletion.

The progenitors of *villosum*, as of other species of *Polemonium*, are still more ancient. In a chart "showing the postulated affinities between the recognized entities in *Polemonium*," Davidson (1950) indicates that *P. reptans* is related to *P. delicatum* Rydb. and more distantly, to *P. pulcherrimum* Hook., both of which are western species. *P. delicatum* of the Rocky Mountains of Colorado, Utah, Arizona, and New Mexico, is a glandular-pubescent species, which suggests closer relationship to *villosum* than to *reptans*. Another pair of species (or subspecies) displays a comparable east-west relationship—*P. Van Bruntiae* Britt. of circumscribed eastern range and *P. occidentale* Greene of the western mountains. Such relationships must be ancient. *P.*

*reptans*, in the restricted sense, is a widespread species found almost throughout the Deciduous Forest (mostly north of the Coastal Plain), and northward into Minnesota, central Wisconsin, northern Vermont and New Hampshire. It is common in the glaciated territory. The ancestral stock, from which *villosum* and perhaps *delicatum* were early differentiated, probably gave rise to other variants, and later, perhaps in late Pleistocene, to the glabrous *reptans*. Other lines of development in *Polemonium* include both glabrous and pubescent forms. Rapid spread of the glabrous *reptans* in late Pleistocene and post-Pleistocene time brought it into proximity with some of the relic populations of *villosum*, resulting in occasional hybridization, wherever the two came into actual contact. Thus *reptans* acquired some of its variability. Analysis of the scatter diagram (Fig. 4) supports this contention.

If the ten individuals most like each other and the ten least like each other on the basis of the measurements used on the horizontal and vertical axes of the graph be selected for determining average ray value for the other five characters (zero for no ray, one for a short ray, two for a long ray), it is found that perfect *villosum* would have a score of ten, and perfect *reptans* a score of zero. Actually, the ten individuals of *villosum* to the upper left in the diagram have an average ray value of 9.0; the ten individuals of *reptans* to the lower right have an average ray value of 0.4, both of which values are close to the perfect score. The ten *villosum* closest to *reptans* have an average ray value of 7.8; the ten *reptans* closest to *villosum*, a value of 0.9. This means that all seven characters, the two on the axes and the five on the rays, are tending to go together. Comparable analysis of the diagram of the mongrel population (Fig. 5) shows that the ten most like *villosum* have an average ray value of 7.1 (lower than the lower value of the *villosum* population); the ten most like *reptans* have an average ray value of 3.5. That is, the average values are intermediate, and the same tendency of all characters to go together which is seen in Fig. 4 is illustrated here.

Only further studies of *P. reptans* throughout its range will make possible the determination of centers of variability, of clines which could be the result of introgressive hybridization, of contamination of the glabrous *reptans* stock with the glandular-

villous stock of *villosum*. Such clines would give clues to time and direction of migration. The most prominent appears to extend in general westward of the area of the *villosum* populations in southern Ohio; another, less marked, is evident in southeastern Pennsylvania, where pubescence of many plants suggests that a relic population of *villosum* once existed thereabouts.

This situation in the *Polemonium reptans* complex is comparable to that of the wild black cherries discussed by McVaugh (1951, 52)—a common and widespread taxon (*Prunus serotina* subsp. *serotina*) ranging almost throughout the Deciduous Forest, in both glaciated and unglaciated areas, and a highly localized taxon (*P. serotina* subsp. *hirsuta*) occurring in areas where there are other disjuncts and rare local endemics. This latter is interpreted as more ancient than the glabrous and widespread *serotina*, and more closely related to western subspecies. The entire range of this complex, as of many other phylads, is somewhat V-shaped, with an eastern and western arm. *Polemonium* has a range comparable to that of the *Prunus serotina* complex, with representatives in Mexico, the East, and the West.

In view of the distinctness of *reptans* and *villosum* demonstrated by the pictorialized scatter diagram (Fig. 4), it is evident they should be maintained as distinct taxa. For the present, then, *Polemonium reptans* includes the two distinct entities, *P. reptans* L. var. *reptans* and *P. reptans* L. var *villosum*, E. L. Braun. Whether the status of *villosum* should be changed to subspecies (which now appears suitable), or whether it should be maintained as a variety of *P. reptans* as originally described (1940) awaits further investigation. If the zoologist's definition of subspecies be accepted—"a geographically defined aggregate of local populations which differs taxonomically from other such subdivisions of the species"—then *villosum* is a subspecies, not a variety, which term is "limited to discontinuous variants within a single interbreeding population" (Mayr, Linsley, & Usinger, 1953). Certainly it is not a mere forma based on an "evanescent" character; it forms pure populations.—UNIVERSITY OF CINCINNATI.

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# A SECOND LIST OF FRESHWATER ALGAE CHIEFLY FROM NEW BRUNSWICK

Herbert Habeeb and Francis Drouet

This paper is a continuation of the work initiated in 1947, and reported upon in Rhodora Vol. 50, March, 1948.

The material dealt with in this paper was collected during the years 1948–1951. In the winter of 1948–49 collections were made right through the cold months to show that the algal flora of our rivers and brooks is active the year round. In collections made from Little River and several brooks in the vicinity of Grand Falls during January and February of 1949, the following species are worth noting; *Batrachospermum moniliforme, Calothrix parietina, Chlorotylium cataractarum, Draparnaldia plumosa, Entophysalis rivularis, Leptosira Mediciana, Phormidium autumnale, P. purpurascens, P. Setchellianum, P. uncinatum, Rivularia haematites, R. rufescens, Rhizoclonium hieroglyphicum, Tetraspora gelatinosa, Tolypothrix penicillata,* and *Spirogyra Grevilleana.*—This last being in a sterile state.

The determinations were all made by Francis Drouet except that several numbers of *Characeae* were kindly determined for us by Mrs. Fay K. Daily, and that the naming of the *Zygnemataceae* is the responsibility of Herbert Habeeb. In this connection, it may be well to mention that all the species reported in this list are based upon dried herbarium macrospecimens. We are grateful to Rev. Irénée-Marie for his careful examination of two of the numbers for desmids. This resulted in his description of the novelty, *Staurastrum Habeebense,* from small ledge pools in the canyon at Grand Falls, New Brunswick.

The collection numbers given are those of Herbert Habeeb. Complete sets of the specimens are in the possession of the Cryptogamic Herbarium, Chicago Natural History Museum, and in the collections of Herbert Habeeb and Francis Drouet. Many of the numbers will be found duplicated in other herbaria.

Unless otherwise indicated, the specimens are from Victoria County, New Brunswick. A number of specimens are included that were collected in adjacent Aroostook County, Maine; these are indicated by placing "Maine" after the collection number. Also listed are a number of specimens from Mt. Albert in the

Gaspé region of Québec; these are indicated by placing "Gaspé" after the number. Some species from our first list of New Brunswick algae are again included to show recent changes in nomenclature and present appropriate synonymy.

Agmenellum thermale (Kütz.) Dr. & Daily. synonyms: *Merismopoedia thermalis* Kütz. collection numbers: 10940. 10982. In a brooklet.

Anabaena oscillarioides Bory. 10430. Wet swamp bottom.

A. variabilis Kütz. 11682, Albert County. 11345, Maine. 11468, Maine. In a ledge pool. In a ditch. On exposed mud of a pond.

Anacystis dimidiata (Kütz.) Dr. & Daily. *Gloeocapsa dimidiata* (Kütz.) Dr. & Daily. *G. turgida* (Kütz.) Hollerb. 10582. 11414 in part. 11620 in part, Madawaska County. Ledge pool. Shore of a lake. In a pond.

A. montana (Lightf.) Dr. & Daily. *Gloeocapsa alpicola* (Lyngb.) Born. 1792, Gaspé. 10456. 10476. 10556. 10558. 10586. 10646. 10687. 10704. 11474, York County. 11581, York County. 11582 in part, York County. 11651. 11672 in part. 11673 in part. 11674 in part. 11683 in part, Albert County. On ledge and canyon wall. In ledge pools. On vegetation in a brooklet. Off a twig in a lake. On a boulder near a spring. On a concrete water-tub at a spring. On a rock in a lake, top Mt. Albert.

A. montana, f. minor (Wille) Dr. & Daily. 11491. In a shallow ledge pool.

A. thermalis (Menegh.) Dr. & Daily. *Gloeocapsa minuta* (Kütz.) Hollerb. *G. membranina* (Menegh.) Dr. & Daily. 10671. 10966 in part. 11414 in part. In ledge pools. Shore of a lake.

A. thermalis, f. major (Lagerh.) Dr. & Daily. *Gloeocapsa limnetica* (Lemm.) Hollerb. 11657 in part. In a lake.

Ankistrodesmus falcatus (Corda) Ralfs. 10623. 10663 in part. On ledge above river surface. In a ledge pool.

Aphanochaete repens A. Br. 10368. 10627. 10706. In ledge pools. Bog part of a small lake.

Aulosira implexa B. & F. 10772. On wet ground.

Bulbochaete minor A. Br. 10332. In a ledge pool.

Calothrix parietina (Näg.) Thur. *Calothrix parietina* B. & F. 1778, Gaspé. On debris in a pool, top Mt. Albert.

Capsosiphon fulvescens (Ag.) Setch. & Gard. 13475, Sussex County. In a well at the salt springs, Sussex.

Chaetophora incrassata (Huds.) Haz. 10347. 10613. 10839. 11206. 11208. 11538. 11625. On vegetation, rocks, etc. in lakes, brooks and ponds.

Chara globularis Thuill. 11543. In a lake. Determined by Mrs. Fay K. Daily.

Cladophora crispata (Roth) Kütz. 1966, Gaspé. In a falls, 10½ miles "North" of the hotel at Mt. Albert.

Coccochloris elabens (Bréb.) Dr. & Daily. 10349. 11157. 11414 in part. 11437. 11522. 11650. 11655. 11657 in part. In lakes.

C. Peniocystis (Kütz.) Dr. & Daily. 11087. In a lake.

C. stagnina Spreng., *Anacystis rupestris* (Lyngb.) Dr. & Daily. 10917. 10927. 11218. 11416. In a ledge pool. On ledge near falls. In lakes.

Coleochaete scutata Bréb. 11623. On clam shells in a lake.

Cylindrocystis cylindrospora (Bréb.) Dr. & Daily. *Cylindrocystis Brebissonii* Menegh. 1779 in part, Gaspé. 10521. 10573. 10575. 11264. 11269. 11270. 11271. 13429 in part. In ledge pools. Ditches. Shore of a small lake, top Mt. Albert.

Desmidium Swartzii Ag. 10518. 10599, Maine. Wet bog. In a small pond.

Dichothrix Orsiniana (Kütz.) B. & F. 11494. 13403 in part. In trickling water on a ledge. In a ledge pool.

Entophysalis Lemaniae (Ag.) Dr. & Daily. *Entophysalis Brebissonii* (Menegh.) Dr. & Daily. 10407 in part. On rocks in a brooklet.

E. rivularis (Kütz.) Dr. *Chamaesiphon polonicus* (Rostaf.) Hansg. 1967, Gaspé. 10424 in part. 10425, in part. 10447. 10453. 10500 in part. 10562. 10658. 10667. 10707 in part. 10957 in part. 10993. 11016. 11108. 13353 in part. 13372. 13373. 13375. 13405. 11480 in part, York County. On wet ledges. Ledge pools. On rocks, etc. in brooks. On ledge in a falls 10½ miles "North" of the hotel at Mt. Albert.

E. rivularis, f. papillosa (Kütz.) Dr. & Daily. 11446. 11681, Albert County. On wall of a garden pool. On rocks in a spring.

Eremosphaera viridis DeBary. 11171. In a pond.

Fischerella ambigua (Näg.) Gom. *Fischerella ambigua* (B. & F.) Gom. 1783, Gaspé. Between wet stones, top Mt. Albert.

Gloeotrichia Pisum (Ag.) Thur. 11399. 11609. 11611 in part. 11624. In a pond. On moss and clam shells in a lake.

Gomphosphaeria aponina Kütz. 11463, Madawaska County. 11466, Madawaska County. 11620 in part, Madawaska County. In a pond.

G. lacustris Chod. 10849. In a pool of a brooklet.

Gongrosira Debaryana Raben. 10472. 10954. 11177. 13482, Sussex County. On rocks, etc. in springs and brooks.

Hapalosiphon fontinalis (Ag.) Born. *Hapalosiphon pumilus* (Kirchn.) B. & F. 1790 in part, Gaspé. 1791, Gaspé. 1807 in part, Gaspé. 1899 in part, Gaspé. On wet ground, wet ledges, in tiny lakes, top Mt. Albert.

Hormotila mucigena Borzi. 10963. On rock in a brook.

Hyalotheca dissiliens (Sm. & Sow.) Bréb. 11150, Maine. 11210. 11220 in part. 11590, Maine. In a ditch. Ponds. Lake shore.

H. mucosa (Dillw.) Ehrenb. 11336. In a river.

Palmella Myosurus (Ducluz.) Lyngb. *Hydrurus foetidus* (Vill.) Trevis. 10420. 10454. 10661. 11680, Albert County. In a ledge pool. In brooklets and springs.

Leptosira Mediciana Borzi. 11012. On a rock in a brooklet.

Lyngbya Diguetii Gom. 13471 in part, Sussex County. Well at the salt springs, Sussex.

L. versicolor (Wartm.) Gom. 10742. 11626. 11673 in part. In a ledge pool. Off wood in a lake. On concrete water-tub at a spring.

Mesotaenium rubescens (Bréb.) Dr. & Daily. *Mesotaenium macrococcum* (Kütz.) Roy. 1787, Gaspé. 10555. 11546, Madawaska County. 11675. In a ledge pool. On concrete water-tub at a spring. On bare ground. On ground, top Mt. Albert.

Microcoleus rupicola (Tild.) Dr. 10623 in part. 10633. 10910 in part. 11117. 13474 in part, Sussex County. On ground and ledges along rivers. On salty mud at the salt springs, Sussex.

Microspora amoena (Kütz.) Rabenh. 11106. In a brook.

Mougeotia laetevirens (A. Br.) Wittr. 11536. 11615. In a lake.

Netrium digitus (Ehrenb.) Itzigs. & Rothe. 10527. 10971. 11338 in part. 13398. Bog end of a lake. Ledge pool. In a brooklet. In a river.

N. interruptum (Bréb.) Lutkem. 11400 in part. 11401. In a pond.

Nitella flexilis Ag. 10888, York County. In the St. John River, Fredericton. Determined by Mrs. Fay K. Daily.

Nostoc commune Vauch.? 1744, Gaspé. On ledge, top Mt. Albert.

N. pruniforme (L.) Ag. 11158. 11159. 11436. 11457. In lakes.

N. microscopium Carm. *Nostoc microscopicum* B. & F. 1921, Gaspé. 1925, Gaspé. 1926, Gaspé. 1934, Gaspé. 1991, Gaspé. 1992, Gaspé. On mosses and hepatics in a ditch 2 miles "North" of the hotel at Mt. Albert. On mosses, swampy ground, 2 miles "North" of Cap-Chat.

N. sphaericum Vauch. 10583. 11438. 11458. 11520. 11654. In lakes. Ledge pool.

N. verrucosum Vauch.? 1919, Gaspé. On a boulder, Mt. Albert.

Oocystis Borgei Snow. 10381 in part. On wet ledge.

O. crassa Wittr. 10656. In a ledge pool.

Ophiocytium cochleare (Eichw.) A. Br. 1788, Gaspé. 10363 in part. 11168. 11306, Maine. In ponds. Bog end of a lake. Bottom of a tiny pool, top Mt. Albert.

O. parvulum (Perty) A. Br. 11069 in part, Maine. 11074, Maine. 11079, Maine. 11081, Maine. 11223. 11249 in part, Madawaska County. 11398. In ponds, ditches, etc.

Oscillatoria amoena (Kütz.) Gom. 10426. 10625. 10828. 11103. 11211. 11289. 11424. 11515 in part. 11578 in part. 11601. 11631. 11638. 13380. 13381. 13414. On rocks, gravel, ledges, etc. in brooks and rivers.

O. anguina (Bory) Gom. 10364 in part. 11439 in part. 11440. 11459. In a lake. Bog end of a lake. Pool on shore of a lake.

O. articulata Gardn. 10850. 10673. In a ledge pool. Bottom of a pool on a brooklet.

O. chlorina (Kütz.) Gom. 10343 in part. 10355 in part. In lakes.

O. CURVICEPS Ag. 11391. In a pond on a brook.

O. GRANULATA Gardn. 10364 in part. 11434 in part. In a lake. Bog part of a lake.

O. IRRIGUA (Kütz.) Gom. 10342. 10353 in part. 10477. 10595, Maine. 10942. 10969 in part. 11004. 11413. 11435. 11441. 11539. 11540. 11597? 11602? In lakes. In brooklets. Pond on a brooklet.

O. LIMOSA (Roth) Ag. 10777. 10779. On bottom and floating in an inlet to the St. John River.

O. ORNATA (Kütz.) Gom. 11161. In a lake.

O. PRINCEPS Vauch. 10342 in part. 10343 in part. 11252, Madawaska County. 11411. 11439 in part. 11443 in part. 11451. 11452. In a pond. In lakes.

O. SIMPLICISSIMA Gom. 11207. 11214. In lake. Pool on shore of a lake.

O. SPLENDIDA Grev. 10526. 10549. 11531, Maine. 11553. 11554. 11559. 11562. In a bog. In ponds and lakes.

O. TENUIS, var. TERGESTINA (Kütz.) Rabenh. 10341 in part. 10353 in part. 10355. 11180, Maine. 11198, Maine. In lakes. In a ditch. Brooklet from a swamp.

PALMOGLOEA PROTUBERANS (Sm. & Sow.) Kütz. *Gloeocystis Grevillei* (Berk.) Dr. & Daily. *G. confluens* (Kütz.) Richt. 1743 in part, Gaspé. 1745, Gaspé. 1746, Gaspé. 1757, Gaspé. 1769, Gaspé. 1785 in part, Gaspé. 1786, Gaspé. 1807, Gaspé. 1946, Gaspé. 1964, Gaspé. 1984, Gaspé. 1987, Gaspé. 2034, Gaspé. On wet ledge, on moss, on peat, in a small lake, etc., top Mt. Albert. On a boulder in a ditch, 2 miles "North" of the hotel at Mt. Albert. On ledge at a falls, 10½ miles "North" of the hotel at Mt. Albert. In falls of a brook, 4 miles "North" of Cap-Chat. On moss on a stump, 2 miles "North" of Cap-Chat. On moss on a ledge near the St. Lawrence River, 3 miles "North" of Grosses Roches, Matane County.

PENIUM MARGARITACEUM (Ehrenb.) Bréb. 11408 in part. In a pasture pond.

PHORMIDIUM INUNDATUM Kütz. 10977. 13371 in part. 11307, Maine. On ledge in a brook. On a log in a brooklet. In a pond.

P. PURPURASCENS (Kütz.) Gom. 10907. 11007a. 11596. 11291. In a brooklet.

P. RETZII (Ag.) Gom. 11298, Maine. 11557. On rocks in a brooklet. In a lake outlet.

P. VALDERIANUM Gom. 11093 in part. 11094 in part. 11097. 11098. 11102 in part. In water near shore of a lake, and in a nearby spring pool.

PLECTONEMA NOSTOCORUM Born. *Plectonema Nostocorum* Gom. 1927, Gaspé. Off moss in a ditch, 2 miles "North" of the hotel at Mt. Albert.

P. TOMASINIANUM (Kütz.) Born. 11037. On rocks in Little River.

PLEUROTAENIUM TRABECULA (Ehrenb.) Näg. 10411. Pond on a brooklet.

RHIZOCLONIUM HIEROGLYPHICUM (Ag.) Kütz. 10720. 11008. 11023.

11030. 11619, Madawaska County. In trickling water in canyon. In brooklets. In a pond.

R. RIPARIUM (Roth) Harv. 13471, Sussex County. 13472, Sussex County. In wells at the salt springs, Sussex.

RIVULARIA HAEMATITES (DC.) Ag. 10992. On rock in a brooklet.

R. MINUTULA (Kütz.) B. & F. 10755. 11610. On ledges and rocks in Little River. On rocks in a pond.

R. RUFESCENS (Näg.) B. & F. 11029. 11032. 11508. On rocks and ledge in springs and brooklets.

SCENEDESMUS BIJUGA (Turp.) Lagerh. 10579. 10697. 10929. 11535, Maine. 11603, Maine. In ledge pools. Permanent puddle. Roadside pool.

SCHIZOCHLAMYS AURANTIA (Ag.) Dr. & Daily. *Schizochlamys gelatinosa* A. Br. 11153, Maine. 11524. 11656. In a lake. On vegetation in swamp water.

SCHIZOTHRIX ARENARIA (Berk.) Gom. 10770. 10920. On ledge near falls, and on rocks in the St. John River.

S. CALCICOLA (Ag.) Gom. 10375. 10738. Ledge pools.

S. DAILYI Dr. 10425 in part. In a brooklet.

S. LACUSTRIS A. Br. *Schizothrix lacustris* Gom. 1794, Gaspé. Border of a tiny pool, top Mt. Albert.

S. LAMYI Gom. 1749, Gaspé. 1785 in part, Gaspé. On peat, shore of a small lake, top Mt. Albert.

S. LARDACEA (Ces.) Gom. 10967. 11561 in part. 11664 in part. On a boulder, shore of a lake. Side of a ledge pool. On wet wood in a lake outlet.

S. LATERITIA (Kütz.) Gom. 10928. In a ledge pool.

S. MELLEA Gardn. 1742 in part, Gaspé. 1776, Gaspé. In a water trickle on a ledge, top Mt. Albert. On peat, shore of a small lake, top Mt. Albert.

S. MUELLERI Näg. 11486 in part, York County. On ground in forest.

S. PURPURASCENS (Kütz.) Gom. 11486 in part, York County. On ground in forest.

SCYTONEMA DENSUM (A. Br.) Born. 1752, Gaspé. On wet ledge, top Mt. Albert.

S. MIRABILE (Dillw.) Born. *Scytonema figuratum* B. & F. 1742 in part, Gaspé. In a water trickle on a ledge, top Mt. Albert.

S. TOLYPOTRICHOIDES Kütz. 11442. 11636. In a brooklet. Lake shore.

SPHAERELLA LACUSTRIS (Girod.) Wittr. 1750, Gaspé. On rocks in a tiny pool, top Mt. Albert.

SPIROGYRA CATENAEFORMIS (Hass.) Kütz. (Also spelled CATENIFORMIS). 10780. 10781. 10812. 10820. 10837. 10841. 10846 in part. 10939. 11068, Maine. 11073, Maine. 11176. 11287. 11384, Restigouche County. 11385, Restigouche County. 11447? 11594 in part. In brooklets, freshwater pools, springs, ponds, etc.

S. COMMUNIS (Hass.) Kütz. 11349, Maine. In a pond.

S. CONDENSATA (Vauch.) Kütz. 11277. 11278. 11279. 11280. 11281 in part. 11282. 11341. Inlet of the Tobique River. Pond, bed of the Tobique River. In a spring, shore of the Tobique River.

S. CRASSA Kütz. 11430 in part. 11444 in part. 11465, Madawaska County. In lakes and ponds.

S. DUBIA Kütz. 10530. 10533. 10543. 10545. 10547. 10548. 10594, Maine. 11350, Maine. 11351 in part. 11429 in part. 11456, Maine. In a ditch. Lakes and artificial ponds.

S. FLUVIATILIS Hilse. 10915. 10925. 10926. 11110. 11472, Maine. 11495. In a ledge pool. On and between rocks in a pond outlet, Caribou.

S. GRACILIS (Hass.) Kütz. 11137 in part, Maine. 11235, Maine. 11309 in part, Maine. In a pond. Ditches.

S. GREVILLEANA (Hass.) Kütz. 10930. 10989. 11066 in part, Maine. 11067 in part, Maine. 11113, Maine. 11138 in part, Maine. 11142, Maine. 11304, Maine. In a ledge pool. Brooklet. In ditches.

S. HANTZSCHII Rabenh. 11147, Maine. 11183, Maine. 11293, Maine. 11342, Maine. 11343, Maine. In a ditch.

Our material is a perfect match with the type itself except for the ornamentation of the inner membrane of the spores. In all probability, our material was not ripe enough to show an ornamentation of the inner membrane.

S. INFLATA (Vauch.) Kütz. 10490. 11066 in part, Maine. 11067 in part, Maine. 11138 in part, Maine. 11141, Maine. 11400 in part. In a pond. Freshwater pool. In ditches.

S. JUERGENSII Kutz.? 10819. In a ledge pool.

S. LONGATA (Vauch.) Kütz. 11136, Maine. 11139, Maine. 11348, Maine. 11351 in part, Maine. 11392 in part. In ponds.

S. MAXIMA (Hass.) Wittr. 11430 in part. 11433. 11444 in part. 11445. In a lake.

S. NEGLECTA (Hass.) Kütz. 10600, Maine. 10601, Maine. 10906. 11167. 11173. 11174. 11175. 11319. 11393. 11394. 11395. 11429 in part. 11616, Maine. Common in artificial ponds forming dense floating mats.

S. MAJUSCULA Kütz. *Spirogyra orthospira* (Näg.) Kütz. 11412. 11454. In a lake.

S. WEBERI Kütz. 11118. 11228. 11257, Madawaska County. 11258, Madawaska County. 11259, Madawaska County. 11299, Maine. 11403. In ponds. Ledge pool. Slow part of a brooklet.

STIGONEMA MAMILLOSUM (Lyngb.) Ag. 10515 in part. In a lake.

S. PANNIFORME (Ag.) B. & F. 1742 in part, Gaspé. 1777, Gaspé. 1779 in part, Gaspé. 1790 in part, Gaspé. 1793, Gaspé. 1797, Gaspé. 1807 in part, Gaspé. On wet ledge, pool bottom, shore of a small lake, and in a tiny lake, top Mt. Albert.

SYMPLOCA DUBIA (Näg.) Gom. 11489. On ledge in falls.

S. MURALIS Kütz. 10692 in part. 11686, Albert County. 11517. In ledge pools. With *Philonotis* sp. on a damp ledge.

Tetmemorus granulatus (Bréb.) Ralfs. 11322. In a ditch.

Tetraedron minimum (A. Br.) Hansg. 10557. 10570. Ledge pools.

Tribonema bombycinum, f. tenue Haz. 11146, Maine. In a ditch.

Tolypothrix distorta (Hofm.-Bang) Kütz. 10522. Bog shore of a lake.

T. lanata (Desv.) Wartm. 10362. 11164. 11418. Lake and bog part of lake. In a swamp pool.

T. penicillata (Ag.) Thur. 10407 in part. 10471. 10489. 10788. 10956. 10974. 11005. 11035. 11038. 11044. 11048. 11488. On rocks and ledge in Little River and its tributaries.

T. tenuis Kütz. 10515 in part. 11163. 13477, Sussex County. 11498. 11611 in part. 11622. 11627. 11628. On clam shells, vegetation, etc. in lakes. In a well at the salt springs, Sussex.

Ulothrix implexa Kütz. 13478, Sussex County. Salt springs, Sussex.

Vaucheria aversa Hass. 11085, Maine. 11302, Maine. 11311, Maine. In ditches.

V. geminata, var. racemosa (Vauch.) Walz. 11111. 11308 in part, Maine. 11370, Restigouche County. In a brook. Small pond. In a ditch.

Zygnema cyanosporum Cleve? 11337. 11634. In a spring. In a pool, bed of Little River.

Z. decussatum (Vauch.) Ag. 11292 in part. In a brooklet.

Z. insigne (Hass.) Kütz. 11570. 11588, Maine. 11589, Maine. In a ditch. Pasture pool.

Z. pectinatum (Vauch.) Ag. 11281 in part. 11292 in part. 11340. In a brooklet. Inlet of the Tobique River.

Zygogonium ericetorum Kütz. 1795, Gaspé. 10663 in part. 10664. 10665. 11420. Path surface through a bog. Ledge pools. In a flow-way between pools, top Mt. Albert.—Grand Falls, New Brunswick, and the Chicago Natural History Museum.

# ELEVENTH REPORT OF THE COMMITTEE ON PLANT DISTRIBUTION

The tenth report concluded the *Monocotyledoneae*. The present report begins with the *Dicotyledoneae* and includes the families through *Moraceae*, taken in the order of the eighth edition of Gray's Manual. Unlike any of the previous reports the plants included here are all trees and shrubs with the exception of *Saururus*.

The data for these reports have been compiled chiefly from the herbarium of the New England Botanical Club and the herbarium of the Arnold Arboretum and Gray Herbarium.

## Preliminary Lists of New England Plants — xxxvi

The sign + indicates that an herbarium specimen has been seen, the sign — that a reliable printed record has been found and the sign * is used for those plants which are not native in our flora.

| | Me. | N. H. | Vt. | Mass. | R. I. | Conn. |
|---|---|---|---|---|---|---|
| SAURURACEAE | | | | | | |
| Saururus cernuus L. | | | | | + | + |
| SALICACEAE | | | | | | |
| Populus alba L. | * | * | * | * | * | * |
| Populus balsamifera L. | + | + | + | + | + | + |
| Populus balsamifera var. subcordata Hylander | + | | + | | | |
| Populus canescens (Ait.) Sm. | | | | | | * |
| Populus deltoides Marsh. | + | + | + | + | + | + |
| Populus deltoides var. missouriensis (Henry) Rehd. | | | | | | + |
| Populus × gileadensis Rouleau (balsamifera × deltoides) | + | + | + | + | + | + |
| Populus grandidentata Michx. | + | + | + | + | + | + |
| Populus heterophylla L. | | | | | | + |
| Populus nigra L. var. italica Muenchh. | * | * | * | * | * | * |
| Populus tremuloides Michx. | + | + | + | + | + | + |
| Populus tremuloides var. magnifica Viet. | + | + | | | | |
| Populus tremuloides f. pendula Jaeger and Beisner | + | | | | | |
| Populus tremuloides f. reniformis Tidestr. | + | | | | | + |
| Salix alba L. | * | * | * | * | | * |
| Salix alba var. calva G. F. W. Mey. | * | * | * | * | | * |
| Salix alba var. vitellina (L.) Stokes | * | * | * | * | * | * |
| Salix alba × fragilis | * | * | * | * | * | * |
| Salix amygdaloides Anderss. | | | — | + | | |
| Salix arctophila Cockerell | + | | | | | |
| Salix argyrocarpa Anderss. | + | + | | | | |

| | Me. | N. H. | Vt. | Mass. | R. I. | Conn. |
|---|---|---|---|---|---|---|
| Salix babylonica L. | | | * | * | | * |
| Salix Bebbiana Sarg. | + | + | + | + | + | + |
| Salix Bebbiana var. capreifolia Fern. | | | | | | + |
| Salix Bebbiana × discolor | | | | + | | |
| Salix Bebbiana × gracilis | | | | + | | |
| Salix Bebbiana × rigida | | | | + | | |
| Salix candida Flügge | + | | + | + | | + |
| Salix candida f. denudata (Anderss.) Rouleau | | | + | + | | + |
| Salix candida × Bebbiana | | | | + | | |
| Salix candida × gracilis | | | | + | | |
| Salix candida × rigida | | | | + | | |
| Salix Caprea L. | | | | | | * |
| Salix cinerea L. | | | | * | | |
| Salix cinerea × rigida | | | | + | | |
| Salix coactilis Fern. | + | | | | | |
| Salix cordata Michx. | − | | | − | | |
| Salix cordata var. abrasa Fern. | + | | | | | |
| Salix discolor Muhl. | + | + | + | + | + | + |
| Salix discolor var. latifolia Anderss. | + | + | | + | + | + |
| Salix discolor var. Overi C. R. Ball | + | | | | | |
| Salix discolor × humilis | + | + | + | + | + | |
| Salix fragilis L. | * | * | * | * | * | * |
| Salix glaucophylloides Fern. | + | | | | | |
| Salix glaucophylloides f. lasioclada Fern. | + | | | | | |
| Salix gracilis Anderss. | + | + | + | + | | + |
| Salix gracilis var. textoris Fern. | + | + | + | + | + | + |
| Salix gracilis × humilis var. microphylla | | | | + | | |
| Salix gracilis × sericea | | | | + | | |
| Salis × Grayi Schneid. (argyrocarpa × planifolia) | | + | | | | |
| Salix herbacea L. | + | + | − | | | |
| Salix humilis Marsh. | + | + | + | + | + | + |
| Salix humilis var. hyporhysa Fern. | | | | | | + |
| Salix humilis var. keweenawensis Farw. | + | + | + | | | |
| Salix humilis var. microphylla (Anderss.) Fern. | + | + | | + | + | + |
| Salix humilis f. curtifolia Fern. | | | | + | | |
| Salix humilis f. festiva Fern. | | | | + | | |
| Salix humilis f. tortifolia Fern. | | | | + | | |
| Salix humilis × gracilis | | | | + | | |
| Salix humilis × sericea | | | | + | | + |
| Salix humilis × humilis var. microphylla | | | | + | | |
| Salix incana Schrank | * | | | | | |
| Salix interior Rowlee | + | + | + | + | | |
| Salix interior var. exterior Fern. | + | | | | | |
| Salix interior f. Wheeleri (Rowlee) Rouleau | | | | | | + |
| Salix × Jesupi Fern. (alba × lucida) | | | | | | + |
| Salix lucida Muhl. | + | + | + | + | + | + |
| Salix lucida var. angustifolia Anderss. | + | + | + | | | |
| Salix lucida var. intonsa Fern. | + | + | − | + | | |
| Salix × myricoides (Muhl.) Carey (rigida × sericea) | + | + | + | + | + | + |
| Salix nigra Marsh. | + | + | + | + | + | + |
| Salix × Peasei Fern. | | + | | | | |

| | Me. | N. H. | Vt. | Mass. | R. I. | Conn. |
|---|---|---|---|---|---|---|
| Salix pedicellaris Pursh | + | | + | | | |
| Salix pedicellaris var. hypoglauca Fern. | + | + | + | + | | + |
| Salix pedicellaris var. tenuescens Fern. | + | + | | + | | |
| Salix pellita Anderss. | + | + | + | | | |
| Salix pellita f. psila Schneid. | + | | | | | |
| Salix pentandra L. | * | * | * | * | * | * |
| Salix planifolia Pursh | + | + | + | | | |
| Salix purpurea L. | * | * | * | * | * | * |
| Salix pyrifolia Anderss. | + | + | + | | | |
| Salix pyrifolia × discolor | + | | | | | |
| Salix rigida Muhl. | + | + | + | + | + | + |
| Salix rigida var. angustata (Pursh) Fern. | + | + | + | + | | + |
| Salix rigida f. mollis (Palmer and Steyerm.) Fern. | | | + | + | + | + |
| Salix rigida × discolor | + | | | + | | |
| Salix rigida × gracilis | + | | | + | | |
| Salix rigida × lucida | | | | + | | |
| Salix rigida × pedicellaris | | | | + | | |
| Salix rigida × subsericea | | | | + | | |
| Salix × rubens Schrank (alba × fragilis) | * | * | * | * | * | * |
| Salix sericea Marsh. | + | + | + | + | + | + |
| Salix serissima (Bailey) Fern. | | | + | + | | + |
| Salix × subsericea (Anderss.) Schneid. (gracilis var. textoris × sericea) | + | | + | + | | + |
| Salix × Smithiana Willd. (viminalis × caprea) | * | | | * | | |
| Salix Uva-ursi Pursh | + | + | + | | | |
| Salix Uva-ursi f. lasiophylla Fern. | | + | | | | |
| Salix viminalis L. | * | | * | * | | |
| MYRICACEAE | | | | | | |
| Comptonia peregrina (L.) Coult. | + | + | + | + | + | + |
| Myrica Gale L. | + | + | + | + | + | + |
| Myrica Gale var. subglabra (Chev.) Fern. | + | + | + | + | + | + |
| Myrica pensylvanica Loisel. | + | + | | + | + | + |
| JUGLANDACEAE | | | | | | |
| Carya cordiformis (Wang.) K. Koch | | + | + | + | + | + |
| Carya glabra (Mill.) Sweet | | + | + | + | + | + |
| Carya ovalis (Wang.) Sarg. | + | + | + | + | + | + |
| Carya ovalis var. hirsuta (Ashe) Sarg. | | | | + | + | |
| Carya ovalis var. obcordata (Muhl. and Willd.) Sarg. | | | | + | | |
| Carya ovalis var. obovalis Sarg. | | | | + | | |
| Carya ovata (Mill.) K. Koch | + | + | + | + | + | + |
| Carya ovata var. Nuttallii Sarg. | | + | | | | |
| Carya ovata var. pubescens Sarg. | | + | | | | |
| Carya tomentosa Nutt. | | + | − | + | + | + |
| Juglans cinerea L. | + | + | + | + | + | + |
| Juglans nigra L. | | | − | + | + | + |
| CORYLACEAE | | | | | | |
| Alnus crispa (Ait.) Pursh | + | + | + | | | |
| Alnus crispa var. mollis Fern. | + | + | + | + | + | |
| Alnus glutinosa (L.) Gaert. | | | | * | | |
| Alnus rugosa (DuRoi) Spreng. | + | + | + | + | + | + |
| Alnus rugosa f. Emersoniana Fern. | + | + | + | + | + | + |
| Alnus rugosa var. americana (Regel) Fern. | + | + | + | + | | |

| | Me. | N. H. | Vt. | Mass. | R. I. | Conn. |
|---|---|---|---|---|---|---|
| Alnus rugosa var. americana f. hypomalaca Fern. | + | + | + | + | | |
| Alnus rugosa var. americana f. tomophylla Fern. | + | | | | | |
| Alnus serrulata (Ait.) Willd. | + | + | + | + | + | + |
| Alnus serrulata f. noveboracensis (Britt.) Fern. | | | | + | + | |
| Alnus serrulata var. subelliptica Fern. | | + | + | + | + | + |
| Alnus serrulata var. subelliptica f. emarginata Fern. | | | | | | + |
| Alnus serrulata var. subelliptica f. mollescens Fern. | | | | + | | + |
| Betula alba L. | | | | * | | |
| Betula borealis Spach | | | + | | | |
| Betula × caerulea Blanch. (populifolia × caerulea-grandis) | | | + | + | | |
| Betula caerulea-grandis Blanch. | + | + | + | | | |
| Betula glandulosa Michx. | + | + | | | | |
| Betula lenta L. | + | + | + | + | + | + |
| Betula lenta f. laciniata Rehd. | | + | | | | |
| Betula lutea Michx. f. | + | + | + | + | + | + |
| Betula lutea var. macrolepis Fern. | + | + | + | + | + | + |
| Betula minor (Tuckerm.) Fern. | + | + | − | | | |
| Betula nigra L. | | + | | + | | + |
| Betula papyrifera Marsh. | + | + | + | + | + | + |
| Betula papyrifera var. commutata (Regel) Fern. | + | + | | + | | |
| Betula papyrifera var. cordifolia (Regel) Fern. | + | + | + | + | + | + |
| Betula papyrifera var. macrostachya Fern. | + | | | | | |
| Betula papyrifera var. pensilis Fern. | + | | | | | |
| Betula papyrifera × populifolia | | | | + | | |
| Betula pendula Roth | | * | | * | | |
| Betula populifolia Marsh. | + | + | + | + | + | + |
| Betula populifolia f. incisifolia Fern. | | | | + | | |
| Betula pumila L. | + | | | + | | + |
| Carpinus caroliniana Walt. var. virginiana (Marsh.) Fern. | + | + | + | + | + | + |
| Corylus americana Walt. | + | + | + | + | + | + |
| Corylus americana f. missouriensis (A. DC.) Fern. | | + | + | + | + | + |
| Corylus cornuta Marsh. | + | + | + | + | + | + |
| Corylus heterophylla Fisch. | | | | | | * |
| Ostrya virginiana (Mill.) K. Koch | + | + | + | + | + | + |
| Ostrya virginiana var. lasia Fern. | | | | + | | |
| FAGACEAE | | | | | | |
| Castanea dentata (Marsh.) Borkh. | + | + | + | + | + | + |
| Castanea pumila (L.) Mill. | | | | + | | |
| Fagus grandifolia Ehrh. | + | + | + | + | + | + |
| Fagus grandifolia f. pubescens Fern. and Rehd. | | | | + | | |
| Fagus grandifolia var. caroliniana (Loud.) Fern. and Rehd. | | | | + | | |
| Fagus sylvatica L. | | | | * | | |
| Fagus sylvatica var. atropurpurea West. | | | | * | | |
| Quercus alba L. | + | + | + | + | + | + |
| Quercus alba f. latiloba (Sarg.) Palmer and Steyerm. | + | + | + | + | + | + |

| | Me. | N. H. | Vt. | Mass. | R. I. | Conn. |
|---|---|---|---|---|---|---|
| Quercus alba f. repanda (Michx.) Trel. | + | | | + | | |
| Quercus × Bebbiana Schneid. (alba × macrocarpa) | | | + | | | |
| Quercus bicolor Willd. | + | + | + | + | + | + |
| Quercus coccinea Muenchh. | + | + | + | + | + | + |
| Quercus × Faxoni Trel. (alba × prinoides) | | | | + | | |
| Quercus × Fernowi Trel. (alba × stellata) | | | | + | | |
| Quercus ilicifolia Wang. | + | + | + | + | + | + |
| Quercus imbricaria Michx. | | | | * | | |
| Quercus × Leana Nutt. (imbricaria × velutina) | | | + | | | |
| Quercus macrocarpa Michx. | + | | + | + | | + |
| Quercus macrocarpa f. olivaeformis (Michx. f.) Trel. | | | + | + | | |
| Quercus Muehlenbergii Engelm. | | | + | + | | + |
| Quercus Muehlenbergii f. Alexanderi (Britt.) Trel. | | | | | | + |
| Quercus palustris Muenchh. | | | − | + | + | + |
| Quercus × Porteri Trel. (rubra × velutina) | | | | + | | |
| Quercus prinoides Willd. | | + | + | + | + | + |
| Quercus prinoides var. rufescens Rehd. | | | | + | | |
| Quercus Prinus L. | + | + | + | + | + | + |
| Quercus × Rehderi Trel. (ilicifolia × velutina) | | | | + | + | |
| Quercus × Robbinsii Trel. (coccinea × ilicifolia) | | | | + | + | |
| Quercus Robur L. | * | * | | * | * | |
| Quercus rubra L. | + | + | + | + | + | + |
| Quercus rubra var. borealis (Michx. f.) Farw. | + | + | + | + | | |
| Quercus × Saulii Schneid. (alba × Prinus) | | | − | + | + | |
| Quercus stellata Wang. | | | | + | + | + |
| Quercus stellata var. Margaretta (Ashe) Sarg. | | | | + | | |
| Quercus × stelloides E. J. Palmer (stellata × prinoides) | | | | + | + | |
| Quercus velutina Lam. | + | + | + | + | + | + |
| Quercus velutina f. dilaniata Trel. | + | + | + | + | + | + |
| Quercus velutina f. macrophylla (Dippel) Trel. | + | + | + | + | + | |
| Quercus velutina f. pagodaeformis Trel. | | | | + | + | |
| ULMACEAE | | | | | | |
| Celtis occidentalis L. | | | | + | | + |
| Celtis occidentalis var. canina (Raf.) Sarg. | | | + | | | |
| Celtis occidentalis var. pumila (Pursh) Gray | | + | + | + | + | + |
| Ulmus americana L. | + | + | + | + | + | + |
| Ulmus americana f. alba (Ait.) Fern. | + | + | + | + | + | + |
| Ulmus americana f. intercedens Fern. | + | + | | + | | + |
| Ulmus americana f. laevior Fern. | + | + | + | + | + | + |
| Ulmus americana f. pendula (Ait.) Fern. | + | + | + | + | + | + |
| Ulmus glabra Huds. | | | | * | * | * |
| Ulmus procera Salisb. | * | | * | * | | |
| Ulmus rubra Muhl. | + | + | + | + | + | + |
| Ulmus Thomasi Sarg. | | | + | + | | |
| MORACEAE | | | | | | |
| Broussonatia papyrifera (L.) Vent. | | | | | * | * |
| Ficus Carica L. | | | | * | | |
| Maclura pomifera (Raf.) Schneid. | | | | * | | * |
| Morus alba L. | * | * | * | * | * | * |
| Morus rubra L. | | | + | + | + | + |

One tree that might have been included in the above list is *Quercus falcata Michx. var. pagodaefolia Ell.* as Mr. Eugene P. Bicknell in his "Ferns and Flowering Plants of Nantucket" records a single individual growing on Nantucket. He also refers to a similar tree growing at Fairhaven, Massachusetts. It seems doubtful if this variety is really a part of our New England flora. *Castanea pumila* is included as occurring in Massachusetts, based on a single specimen from Stony Brook Reservation. That this is a native to Massachusetts is questionable.

*Saururus cernuus*, the only herbaceous species in this list, is a southern species occurring in the Naugatuck and Thames Valleys of Connecticut and at Little Compton, Rhode Island.

Certain trees are included which very evidently have been planted. *Ficus Carica* is in the list but it could hardly be considered as part of the flora. Other trees like *Populus alba*, *Salix alba*, *S. fragilis* and their hybrids are so firmly established that it is hard to realize that they are not native. *Populus nigra var. italica* is an interesting example of a widely distributed tree that depends entirely on propagation from cuttings. In the highway developments in recent years *Salix pentandra* has been extensively planted.

Many hybrids have been found and probably more exist that have not been identified as such. The hybrids have been omitted from the following distributional categories as have also varieties and forms which seem to have no geographical significance. Geographically the species here considered fall into groups which have already been used and defined in previous reports but in the present list there are no speimens to represent marine or estuarine habitats.

I. GENERALLY DISTRIBUTED.—*Populus grandidentata, P. tremuloides, Salix Bebbiana, S. discolor, S. humilis, S. lucida, S. rigida, S. sericea, Myrica Gale, Betula lutea, B. papyrifera, B. papyrifera var. cordifolia, Ostrya virginiana, Corylus cornuta, Fagus grandifolia.*

Wide ranging species are usually northern. Exceptions are *Ostrya virginiana* and *Fagus grandifolia* which represent species coming into New England from the Appalachian area in the southwest.

*Myrica Gale* (typical) is wide spread but the *var. subglabra*

is rare, occurring only in Connecticut, Rhode Island and northern Maine. While the Canoe Birches, (*Betula papyrifera* and the *var. cordifolia*), are very generally distributed, the *var. commutata* is represented by too few specimens to point to a definite range and the *var. pensilis* has been reported only from Dacey Dam and Pembroke in Maine.

II. RATHER GENERAL EXCEPT CAPE COD AND WASHINGTON COUNTY, MAINE.—*Salix rigida, var. angustata, Betula lutea var. macrolepis, Ulmus americana.*

The distribution of *Salix rigida var. angustata* seems to be much more restricted than the species. This may be more apparent than real as this variety has not been recognized until recently. *Betula lutea var. macrolepis* seems to be absent also from Aroostook County. Herbarium material of *Ulmus americana* may not be indicative of its actual range. Many collectors have failed to include it from an area in the belief that it might have escaped from cultivation.

III. NORTHERN, WITH NUMEROUS STATIONS SOUTH OF 43°.—*Populus balsamifera, Salix pedicellaris* and *S. pedicellaris var. hypoglauca, S. gracilis* and *S. gracilis var. textoris, Alnus rugosa,* and its varieties.

*Salix pedicellaris* is more northern and much more local than its *var. hypoglauca.* Although *Salix gracilis* and its *var. textoris* (formerly known as *S. petiolaris*) have approximately the same range, the variety is much more frequent.

IV. NORTHERN, NOT MUCH SOUTH OF 43°.—*Populus tremuloides var. magnifica, Salix coactilis, S. lucida var. angustifolia* and *var. intonsa, S. pellita, S. pyrifolia, Alnus crispa var. mollis, Betula caerulea-grandis, Quercus rubra var. borealis.*

*Salix coactilis* occurs only in Maine where it is local, chiefly in the Penobscot River Valley. The *varieties angustifolia* and *intonsa* of *Salix lucida* are much more northern and restricted in their distribution than the typical form which is widely distributed in New England.

V. ALPINE.—*Salix arctophila, S. argyrocarpa, S. herbacea, S. planifolia, S. Uva-ursi, Alnus crispa, Betula borealis, B. glandulosa, B. minor.*

The exact distribution can be better understood from the following table:

| | | | |
|---|---|---|---|
| Mt. Katahdin | Mt. Katahdin and White Mts. | Mt. Katahdin, White Mts. and Vermont | Mt. Katahdin and northern Vermont |
| *Salix arctophila* | *S. argyrocarpa*<br>*S. herbacea*<br>*Betula glandulosa*<br>*B. minor* | *S. planifolia*<br>*S. Uva-ursi*<br>*Alnus crispa* | *Betula borealis* |

VI. CAPE COD, GENERAL IN MAINE SOUTH OF 45°, BUT NOT NORTHERN MAINE.—*Salix nigra, Myrica pensylvanica, Comptonia peregrina, Alnus serrulata, Betula populifolia, Carpinus caroliniana var. virginiana, Corylus americana, Castanea dentata, Quercus alba, Q. bicolor, Q. ilicifolia, Q. rubra, Q. velutina.*

*Myrica pensylvanica* is confined to southeastern New England and the Maine coast. *Quercus velutina* is largely in southern New England but extends into southern New Hampshire and southwestern Maine. Of more general distribution are *Salix nigra, Comptonia peregrina, Betula populifolia,* and *Quercus rubra.* Other species extend east only to the Penobscot Bay and River: *Alnus serrulata* (only 2 stations beyond the Kennebec), *Carpinus caroliniana var. virginiana, Corylus americana, Castanea dentata, Quercus alba, Q. bicolor* and *Q. ilicifolia* (with only one station on Mt. Desert).

VII. NEITHER CAPE COD NOR NORTHERN MAINE AND NOT IN WASHINGTON COUNTY, MAINE.—*Ulmus rubra, Betula lenta, Juglans cinerea, Carya ovata.*

*Ulmus rubra* is general in New Hampshire, Vermont, Massachusetts (except Cape Cod) and Connecticut but rare in Maine and Rhode Island. *Betula lenta* has some stations in Vermont, southern New Hampshire and southeastern Maine. *Carya ovata* and *Juglans cinerea* do not extend beyond the Kennebec River.

VIII. CHIEFLY THE THREE SOUTHERN STATES.—*Quercus prinoides, Q. coccinea, Carya ovalis, C. glabra, Alnus serrulata var. subelliptica.*

*Quercus prinoides* has a few stations in southern Vermont and southern New Hampshire while *Q. coccinea* with the same distribution extends to York and Cumberland Counties, Maine. *Carya ovalis* is represented by 2 Maine stations, 3 New Hampshire and one Vermont but is too poorly known for any discussion. *Carya glabra* extends into southwestern Vermont and southern New Hampshire. *Alnus serrulata var. subelliptica* is more southern than the typical form but has one station in New Hampshire and one in Vermont.

IX. CHIEFLY THE THREE SOUTHERN STATES BUT NOT IN WESTERN MASSACHUSETTS.—*Saururus cernuus, Salix humilis var. microphylla, Carya tomentosa, Quercus stellata.*

*Saururus cernuus* comes in from the south and west and is confined to Connecticut with the exception of one station in Rhode Island. *Salix humilis var. microphylla* (*S. tristis*) reaches southern New Hampshire and has one station in Maine on Mt. Desert. *Carya tomentosa* has one New Hampshire station but none in Maine. *Quercus stellata* is limited to extreme southern Connecticut, Rhode Island, Cape Cod and the Islands.

X. CHIEFLY THE THREE SOUTHERN STATES BUT NOT ON CAPE COD.—*Carya cordifolia, Quercus Prinus, Celtis occidentalis* and its *vars. canina* and *pumila.*

*Carya cordiformis* extends up into western Vermont. *Quercus Prinus* occurs in western and southern Vermont, southern New Hampshire and southeastern Maine. *Celtis occidentalis* occurs in western Vermont and the *var. pumila* in the Connecticut Valley in Vermont and New Hampshire.

XI. CHIEFLY THE THREE SOUTHERN STATES BUT NEITHER CAPE COD NOR WESTERN MASSACHUSETTS.—*Quercus palustris.*

XII. COASTAL PLAIN.—*Salix humilis var. hyporhysa, Ostrya virginiana var. lasia, Quercus prinoides var. rufescens, Quercus stellata var. Margaretta.*

The typical form of *Quercus stellata* although it also occurs on the trap ridges of the New Haven, Connecticut, area is usually considered to be a coastal plain species.

XIII. CALCICOLOUS, CHIEFLY WEST OF THE CONNECTICUT RIVER IN THE SOUTH BUT IN THE EAST MOSTLY NORTH OF 45°.—*Salix candida, S. glaucophylloides, Betula pumila, Quercus macrocarpa.*

*Salix candida* has one station in Essex County, Massachusetts. *S. glaucophylloides* is found only in northern Maine. *Betula pumila* grows in the limestone areas of western Connecticut and western Massachusetts and in northern Maine with one station at Orono in central Maine. *Quercus macrocarpa* occurs in western New England and central Maine.

XIV. RIVER VALLEYS, CHIEFLY OF WESTERN NEW ENGLAND.—*Salix serissima, Quercus Muehlenbergii, Ulmus Thomasi.*

XV. MISCELLANEOUS.—*Populus deltoides, P. heterophylla, Salix amygdaloides S. interior, S. interior var. exterior, Juglans nigra, Betula nigra, Morus rubra.*

In some cases native species have been so widely planted beyond their normal range that the plotting of their natural distribution is difficult. *Populus deltoides*, the Cottonwood, is a western species which reaches western New England as a native plant but has been extensively planted farther east. *Juglans nigra* is another western species which occurs as a native in western New England but is planted in the east. *Morus rubra* is native in western Connecticut, western Massachusetts and southwestern Vermont but is also planted in southern New England.

*Populus heterophylla*, another western species, is only represented in southwestern Connecticut. *Salix amygdaloides* is confined to western Vermont and western Massachusetts. *Salix interior* seems to be confined to the Connecticut River Valley and the Lake Champlain region, while the *var. exterior* occurs only in the Aroostock River Valley in Maine. *Betula nigra* is restricted to the Merrimac and Ipswich Rivers and their tributaries except for one station in southwestern Connecticut.—R. C. Bean, C. H. Knowlton, and A. F. Hill.

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## ADDITIONAL EVIDENCE FOR FIVE AS THE BASIC CHROMOSOME NUMBER OF THE ANDROPOGONEAE


Robert P. Celarier


Because of the meager amount of information available on the cytology, genetics, and comparative morphology of the grass tribe *Andropogoneae*, it has not been possible to state with any great amount of assurance what the phylogenetic lines of development are for the tribe. From the cytotaxonomic point of view it is of considerable importance to know what the basic chromosome numbers are, how they originated, and their significance in establishing phylogenetic trends.

Several basic numbers have been suggested for the tribe during the past twenty-five years. Avdulov (1931) found $2n = 36$ from his studies of *Miscanthus floridulus* Warb (as *M. japonicus*) and suggested nine as the basic number for the tribe. Although there is some doubt about the number of this species, since Bremer (1934) has recorded $2n = 38$, there is no question but that nine is the haploid number for several species in the tribe, but whether it is primitive or derived is not established. Seven has also been proposed (Moriya and Kondo, 1950), as well as six (Janaki-Ammal, 1940) but both are rare and there are no diploid species known with either of these numbers. There are also several higher numbers recorded but, for the most part, they are more easily explained as amphiploids involving species with different chromosome numbers. By far the most common numbers recorded for the tribe are multiples of ten, or five (Darlington and Janaki-Ammal, 1945; Delay, 1951).

Apparently the first known case of $n = 5$ was recorded by

Karper (1930) for *Sorghum versicolor*. This was later confirmed by Longley (1932) and Karper and Chisholm (1936). The same number was found for *S. purpureo-sericeum* and *S. dimidiatum* by Huskins and Smith (1932, 1934), *S. nitidum* by Ayyanger and Ponnaiya (1941), and *S. intrans* by Garber (1948). Garber (1950), in a detailed study of the genus, confirmed these findings for all of the species except *S. nitidum* which he found to be 2n = 20. Besides these he found two others, *S. stipoidum* and *S. brevicallosum*, with n = 5, and later *S. matarankense* was added to the list (Garber and Snyder 1951).

Although no other diploid species (n = 5) are known there are several kinds of secondary information that may be brought to bear on the problem.

A few cases of 2n = 30 have been recorded for the tribe. The first was *Narenga porphyrocoma* reported by Bremer (1925), Janaki-Ammal (1941) and Moriya (1950). In these studies, representing the species from most of its range of distribution, the meiotic behavior was regular and 15 bivalents were almost always seen at diakinesis. This was followed by a report of 2n = 30 for *Hyparrhenia hirta* by Garber (1944). He found the meiotic behavior to be essentially normal but with an occasional quadrivalent. This report was substantiated by Krupto (1953), who reported 2n = 30 types from three localities, and by de Wet (1954). Another example of 2n = 30 was found by Brown (1951) in *Erianthus strictus* Baldw. (not Bluff. et Fingerh.) from Texas material. No meiotic studies were made. In the present study another genus is added to this group, as well as two additional species of *Hyparrhenia* and two more collections of *H. hirta*.

*Hyparrhenia hirta* with 30 somatic chromosomes was found in two entries, one from Israel and the other from Assam, India. The latter was undoubtedly introduced since the species is not native to India. Neither of these entries was entirely regular in its meiotic behavior and both had approximately the same types of irregularities (Tables I and II). Some 40–55 per cent of the cells had 15 bivalents at diakinesis and metaphase I (Fig. 2), and although univalents and quadrivalents were not uncommon, no cells were found that had both univalents and quadrivalents. At anaphase and telophase I about fifty per

TABLE I

CHROMOSOME CONFIGURATIONS AT DIAKINESIS AND METAPHASE I

| *Species* | *No.* | *Collector* | *Location* | *2n* | *Range* | *Per cent cells with* 15II | 13II-1IV | 2I-14II | 4I-13II | *Others* |
|---|---|---|---|---|---|---|---|---|---|---|
| *Hyparrhenia hirta* Stapf | A-3184 | A. Kamm | Neveh-Yaar. Israel | 30 | 0-2I, 13-15II, 0-1IV | 40.0 | 30.0 | 30.0 | 0.0 | 0.0 |
| *H. hirta* Stapf | A-3916 | E. Anderson | Assam, India | 30 | 0-2I, 13-15II, 0-1IV | 55.0 | 35.0 | 15.0 | 0.0 | 5.0 |
| *H. rufa* Stapf | A-3126 | R. Strange | Kitale, Kenya | 30 | 0-4I, 13-15II, 0-1IV | 40.0 | 40.0 | 5.0 | 10.0 | 5.0 |
| *H. rufa* Stapf | A-2671 | E. Macari | Central Madagascar | 30 | 0-4I, 10-15II, 0-2IV | 33.3 | 38.9 | 0.0 | 5.6 | 22.2 |
| *H. rufa* Stapf | 306 | | Not known | 30 | 0-4I, 12-15II, 0-1IV | 0.0 | 29.2 | 25.0 | 33.3 | 12.5 |
| *H. formosa* Stapf | A-3130 | R. Strange | Kitale, Kenya | 30 | 0-2I, 11-15II, 0-2IV | 36.4 | 18.2 | 36.4 | 0.0 | 9.0 |
| *Hypogynium spathifolius* Nees | A-3161 | U. S. D. A. | Brazil | 30 | 15II | 100.0 | | | | |

TABLE II

CHROMOSOME BEHAVIOR AT AI AND TI AND DYAD SPORE STAGE

| | *Anaphase and Telophase I* | | | | | | *Dyad Spore* | |
|---|---|---|---|---|---|---|---|---|
| *No.* | *Per cent normal* | *Per cent with lag. chr.* | *No. lag. per cell* | *Av. no. lag.* | *Per cent bridges* | *Per cent frag.* | *Per cent normal* | *Per cent with micronuclei* |
| A-3916 | 45 | 55 | 0–5 | 2.1 | 5 | 5 | 92 | 8 |
| A-3184 | 50 | 50 | 0–5 | 2.3 | 3 | 3 | 88 | 12 |
| A-3126 | 33 | 66 | 0–2 | 1.7 | — | — | — | — |
| A-2671 | 37 | 63 | 0–3 | 1.7 | 10 | 10 | 80 | 20 |
| A-3130 | 40 | 60 | 0–4 | 2.0 | 3 | — | — | — |

cent of the cells had lagging chromosomes (Figs. 3, 4, 5) and these laggards were found both dividing and non-dividing at these stages. Very rarely bridges and fragments were seen (Figs. 3, 5) and these were very likely due to small inversions. At the dyad spore stage only a very small percentage of the cell pairs had micronuclei (Table II).

In a few cells at late telophase I it was still possible to count the chromosomes in each of the daughter nuclei. In several of these cells more than 30 chromosomes were found, with both equal and unequal distributions, and it can be concluded that both divided and undivided univalents are often distributed to the daughter cells. This will help to account for the much smaller percentage of dyads with micronuclei than anaphase or telophase cells with lagging chromosomes.

*Hyparrhenia rufa* with 2n = 30 has also been found, and has been studied from three locations (Tables I and II). Two of the entries are essentially similar in their meiotic behavior but the entry 306 is quite different. However, this difference is due principally to the increased number of univalents found in 306, and the orientation of these univalents at metaphase I (Fig. 7) strongly suggests that this may be due principally to early terminalization of two bivalents.

In A-2671 and A-3126 a high percentage (33–40) of the cells with 15 bivalents at diakinesis and metaphase I occur, and a similar percentage with one quadrivalent is found. Univalents are not uncommon in either case (Fig. 6). Also A-2671 was frequently found to have two quadrivalents.

At anaphase and telophase I approximately 65 per cent of the

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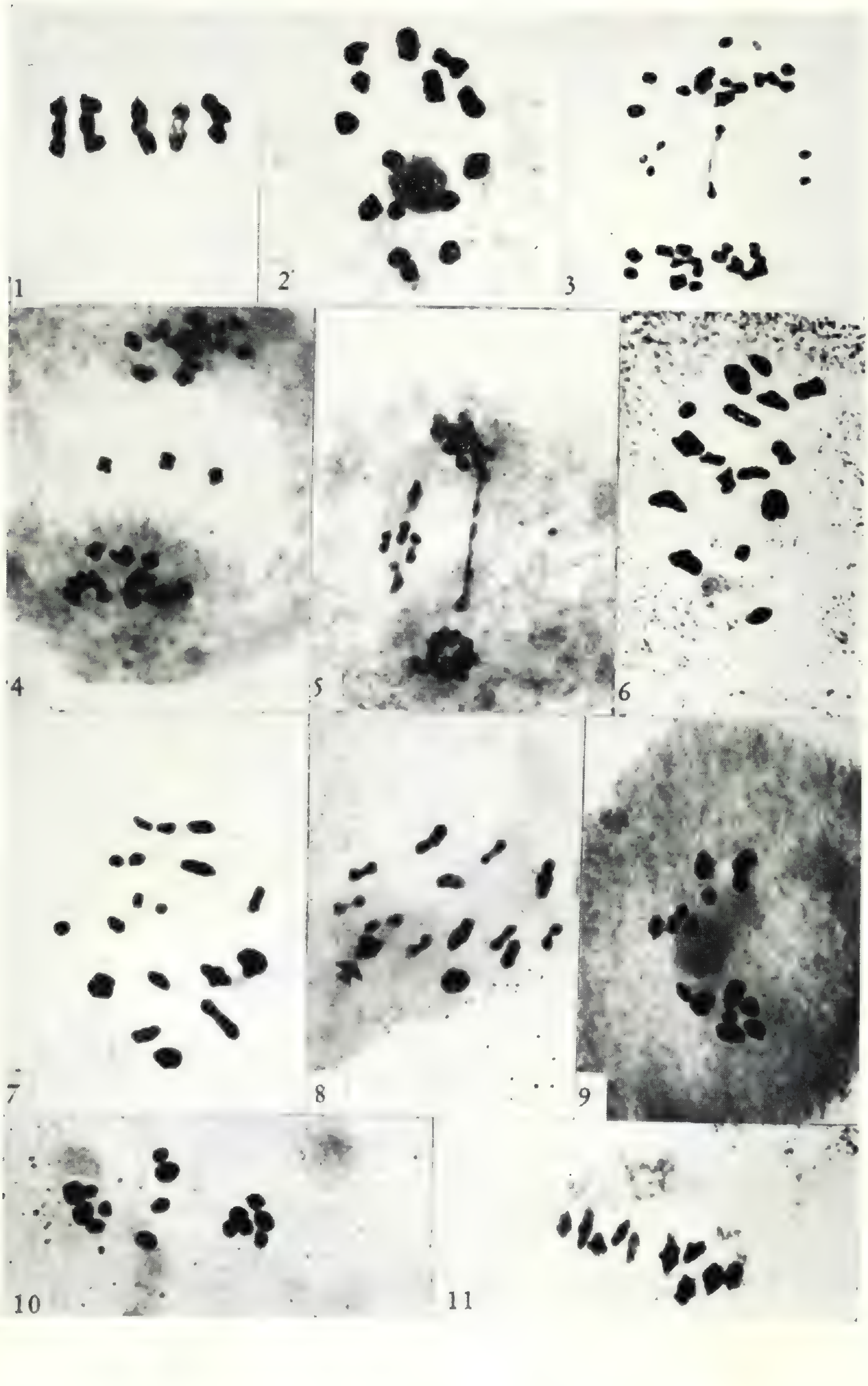
Plate 1226

**Figures 1–11.** Meiosis in the *Andropogoneae*. Fig. 1. Metaphase I in *Sorghum intrans* with five bivalents. Fig. 2. Diakinesis in *Hyparrhenia hirta* A-3916 from Assam, India showing 15 bivalents, five are noticeably larger than the others. Fig. 3. Anaphase I in *H. hirta* A-3184 from Israel with two lagging chromosomes that are dividing, and a bridge + fragment. Fig. 4. Telophase I in *H. hirta* A-3916 with three lagging chromosomes. Fig. 5. Telophase I in *H. hirta* A-3916 showing lagging chromosomes and a bridge + fragment. Fig. 6. Metaphase I in *H. rufa* A-3126 from Kenya with 2 univalents and 14 bivalents, five of the bivalents are larger than the others. (Chromosomes have been touched up with India ink forc ontrast.) Fig. 7. Metaphase I in *H. rufa*, 306 showing univalents whose association to one another suggests early terminalization—note the five large bivalents. Fig. 8. Metaphase I in *H. formosa* A-3130 from Kenya with 15 bivalents, two are lying together. Fig. 9. Diakinesis in *Hypogynium spathifolius* A-3161 from Brazil with 15 bivalents, five of which are very small. Fig. 10. Metaphase I in *H. spathifolius* with 15 bivalents. Fig. 11. Metaphase I in *Dichanthium sericeum* with 10 bivalents, five being considerably smaller than the others. All fig. 1350 ×.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cells studied had lagging chromosomes, although never more than three were seen in any one cell. These laggards were both dividing and non-dividing at these stages. Although only one entry was studied at the dyad stage (Table II) it was similar to *H. hirta* in that there were far fewer dyads with micronuclei than anaphase and telophase cells with lagging chromosomes. The reason is probably similar to that of *H. hirta*.

*Hyparrhenia formosa* with 2n = 30 was seen in one entry from Kenya. It is similar to the other Hyparrhenias at diakinesis and metaphase I except that it had somewhat fewer instances of quadrivalents (Fig. 8) and more cells with univalents. It is also similar to the other species at anaphase and telophase I with 60 per cent of the cells having lagging chromosomes, and as many as four found in one cell.

Although there are differences in frequencies in the various types of configurations found in the *Hyparrhenia* entries, the same general pattern of behavior is seen in all. It is noticeable that four chromosomes are frequently involved in non-bivalent associations, either as a quadrivalent or as univalents. The formation of quadrivalents is usually associated with reciprocal translocation, or homology of the four chromosomes, and it is virtually impossible to distinguish the two except by studies of pachytene chromosomes. However, translocations that produce quadrivalents in no more than 40 per cent of the cells, and with 35–50 per cent bivalents are rather special cases. Their constant occurrence throughout such a wide geographical area as represented by these materials and in three different species seems rather unlikely to the author. On the other hand partial homology between four or more chromosomes (two quadrivalents were found occasionally in *H. rufa* and *H. formosa*) might be expected in a group where speciation was rather active. It seems much more likely that the multivalent formations found in this study are the result of partial homology than of reciprocal translocations.

*Hypogynium spathiflorum* was also found to have 30 somatic chromosomes. This species was studied from one entry collected in Brazil. It was found to have 15 bivalents at diakinesis and metaphase I (Figs. 9, 10), and to have completely regular meiotic divisions.

Another type of secondary information concerning five as a

basic number is seen in chromosome size. In the three species of *Hyparrhenia* included in this study it was noted that five of the chromosome pairs were considerably larger than the others (Figs. 2, 6, 7, 8). Also in *Hypogynium* there was considerable variation in chromosome size and five of the chromosomes were very much smaller than the others (Figs. 9, 10). This difference in size is also often quite noticeable in *Dichanthium sericeum*. This species has 20 somatic chromosomes with ten bivalents at metaphase I and completely regular meiotic divisions. At diakinesis and metaphase I it is usually easy to distinguish five large and five small bivalents (Fig. 11). Although no detailed study has been made of this, it has been noted in several collections of the species.

## Discussion

That the genus *Sorghum* has a basic number of five seems to be fairly certain, both from the numerous accounts of n = 5 known, and also from the occasional bivalents found in haploids of *Sorghum vulgare* (Brown, 1943; Kidd, 1952), and especially from the recovery of chromosome interchanges in the derivatives of crosses of haploids with diploids (Endrizzi and Morgan, 1955).

Several other genera are now known that have species with the somatic chromosome number of 30, and this might be explained in one of the following ways.

1. diploids with a basic number of 15.
2. triploids with a basic number of 10.
3. amphiploids resulting from a cross involving two other basic numbers (6 x 9 or 7 x 8).
4. hexaploids with a basic number of five.

1. If they are diploid species they should be predominately regular in meiotic behavior and any irregularities would be due mostly to structural changes (i.e. quadrivalents would be due to reciprocal translocations). The three *Hyparrhenia* species reported here all have quadrivalents but the meiotic behavior suggests partial homology rather than translocations. Also 15 as the basic number for the tribe is untenable in view of the large number of species with 2n = 10.

2. If they are triploid species one would expect at least one genome to be frequently involved in either the formation of trivalents or univalents. Not a single entry of any of the species studied has even approached this order of irregularity and at least two species are apparently completely regular in meiotic behavior. It seems very unlikely that the 2n = 30 types could have had a triploid origin.

3. If they are amphidiploids they must be of secondary origin involving crosses of species with $n = 6 \times n = 9$ or $n = 7 \times n = 8$. Of these numbers six, seven, and eight are so seldom met with in the tribe, and none yet seen at the diploid level, that this possible origin seems an unlikely one.

4. If they are hexaploids it is possible that they may have arisen as trispecific hybrids in which there is no homology between the chromosomes and as a consequence they have a completely regular meiotic behavior. However, it seems somewhat more likely that they were formed as the result of crosses between rather closely related species in which some homology existed between at least some of the chromosomes. Consequently one might occasionally expect to find species with some multivalent associations. Any selective advantage for fertility would favor chromosomal changes (in the partially homologous chromosomes) that would tend to diploidize them. If this event has occurred the meiotic behavior might indicate the relative time of origin of the hexaploids.

This type of origin of the $2n = 30$ types is not incompatible with the data at hand. Species are known with regular meiotic behavior (*Narenga porphyrocoma* and *Hypogynium spathiflorum*) as well as species that indicate partial homology between four or more chromosomes (*Hyparrhenia* species). Also *Hyparrhenia* is the most highly specialized genus of the ones considered, is probably rather recent in origin and very active in speciation at the present time. Thus if there is a selective advantage for diploidization it would be expected that it would be less well developed in the more recently formed species which in this study would be *Hyparrhenia*.

Therefore the most logical conclusion as to the origin of the $2n = 30$ types appears to be that they are hexaploids with a basic number of five.

With this conclusion it is now possible to study the distribution of $x = 5$ in the tribe as a whole. The tribe is generally divided into six subtribes: 1. *Dimeriinae*, 2. *Saccharinae*, 3. *Ischaeminae*, 4. *Rottboellinae*, 5. *Sorginae*, 6. *Andropogoninae*.

No cytological studies have been made in the *Dimeriinae* and only two genera in the *Ischaeminae* and five in the *Rottboellinae* have been studied. All other subtribes, from the most primitive *Saccharinae*, with *Erianthus* and *Narenga*, to the most advanced *Andropogoninae*, with *Hypogynium* and *Hyparrhenia*, have species with a basic number of five. Also the very closely related and highly specialized tribe *Maydeae* has $n = 5$ in

*Coix* and five is generally regarded as the basic number for the tribe.

There is little question but that n = 10 is the basic material from which most present day species of the *Andropogoneae* have been derived. Consequently any single basic number for the tribe, other than ten, must have developed n = 10 types several times during the evolution of the tribe. Of the numbers that have been proposed, the one that could most easily have made this change is five.

It is not the feeling of the author that the problem of a basic number for the tribe has been completely solved, nor that it is entirely established that the tribe has a monophyletic origin. However, the available evidence strongly suggests that five may have been the basic number, that ten was derived from it principally by allopolyploidy, and that nine is of secondary origin from ten. This seems to offer a fairly reliable working hypothesis.

## Summary

Three types of evidence have been presented supporting five as the basic number for the *Andropogoneae*. First there are species with n = 5, secondly the species with n = 15, and third are the species that have five chromosomes of different morphology from the other chromosomes of the complement.

Although the number of species that are shown, by these methods, to have a basic number of five are few, they are widely distributed in the tribe, being found in both the most primitive and the most advanced subtribes.

It is pointed out that x = 5 is more compatible with the other known numbers in the tribe, and that it should be considered as a working hypothesis. –Department of Botany and Plant Pathology, Oklahoma A & M College, Stillwater.

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# A NEW ELYMUS FROM ALASKA[1]

H. J. Hodgson[2]

A question concerning the identity of a species of *Elymus* considered in other studies arose during the winter of 1954. At that time herbarium specimens of representative material collected in the Matanuska Valley were examined independently by Jason R. Swallen of the Smithsonian Institution, J. L. Stebbins, Jr. of the University of California, D. C. Smith and E. L. Nielsen of the Wisconsin Agricultural Experiment Station and R. W. Pohl of the Iowa Agricultural Experiment Station. All questioned the relegation of this material to *E. canadensis* L. as had been done by Anderson[3] and Lepage.[4] Certain features suggested the species indicated, but all agreed that it did not appear to be closely similar to *E. canadensis* with which they were familiar. The following quotation, taken from Mr. Swallen's letter regarding the herbarium specimens in question, is relatively typical of those received:

> . . . I am not satisfied with calling it *Elymus canadensis*, and on the other hand there is no other species in Alaska or North America that it could be. There is some resemblance to *E. hirsutus*, but none of the lemmas are hirsute toward the summit as in this species. It would seem, then, that this is either a hybrid in itself or a new species.

Subsequently, Nielsen has had opportunity to examine numerous colonies of the plant in question as it occurs naturally in Alaska. It was his opinion that this appeared quite different from any *Elymus canadensis* he was familiar with in the States.

The following description has been drawn to cover the plant for which the name *Elymus pendulosus* is proposed, calling attention to the distinctive pendulose aspect of the spikes.

**Elymus pendulosus** Hodgson, sp. nov.

Planta perennis, caespitosa, rhizomatibus brevibus adscendentibus, viridis vel purpurea; culmi erecti vel basi decumbentes, 40–100 cm.

[1] Contribution from Agronomy Department, Alaska Agricultural Experiment Station, Published with approval of the Director.

[2] Formerly Head, Agronomy Department, Alaska Agricultural Experiment Station.

[3] Iowa State College Jour. of Science **18**:381–445. 1944

[4] Nat. Canad. **79**:241–266. 1952

alti; vaginae glabrae, apertae; laminae planae, supra scabrae, infra scaberulae, 5.0–12.0 mm. latae; spicae setosae, pendulae, 15–30 cm. longae; spiculae remotae, saepe solitariae, interdum ternatae, paulum patulae; glumae 0.5–1.0 mm. latae, 4.0–8.0 mm. longae, 2–4 nervis, scabrae, summo nervis hispidulae, arista hispidula 0.5–7.0 mm. longa praedita; lemmata scabra, basi sparse pilosa, summo nervosa, arista divergente 1.0–3.0 cm. longa praeditum; rachilla summo pubescens.

Plant perennial, caespitose, with short ascending rhizomes, green or often highly pigmented with anthocyanin; culms usually semi-decumbent at base, 40–100 cm. tall; sheaths glabrous, open; blades flat, scabrous above, scaberulous beneath, 5.0–12.0 mm. wide; spike bristly, pendant, 15–30 cm. long; spikelets distant, often solitary, usually in pairs but occasionally three at a node, slightly spreading; glumes 0.5–1.0 mm. wide, 4.0–8.0 mm. long, 2–4-nerved, scabrous, slightly hispid on the distal portion of the nerves; awn 0.5–7.0 mm. long, hispidulous; lemmas scabrous, slightly pubescent at base, strongly nerved above; awn somewhat divergent, 1.0–3.0 cm. long; rachilla pubescent.

*Elymus pendulosus* may be distinguished from *E. canadensis* by: (1) its longer and narrower spikes that are also less dense and more pendant (the latter character contrasts sharply with the nodding character in *E. canadensis*); (2) its spikelets are more distant, often solitary but usually in pairs, only rarely are there three or four per node; (3) its shorter glume awns; (4) the less flexuous lemma awns; and (5) plants are never glaucous. Plants are often highly pigmented with anthocyanin, particularly when encountered in localities away from the immediate coast. In numerous instances the intensity of pigmentation approached a dark reddish purple. It is not possible to state at this time whether any significance can be attached to the fact that colonies observed at Fish Creek and in the Lowe River gorge immediately above Valdez exhibited no anthocyanin development. Additional study will be necessary to determine if distinct genic races occur naturally in the species.

It was possible to define the Alaskan plant more clearly during the past summer. It appears to be indigenous to south central Alaska. It is generally distributed throughout the Matanuska Valley which lies northward and westward from the Knik Arm of Cook Inlet. It was found to be locally abundant along the Glenn Highway to about milepost 103. It becomes much less common in occurrence as one travels into the interior, and occurs only sporadically at Tok Junction beyond which it was

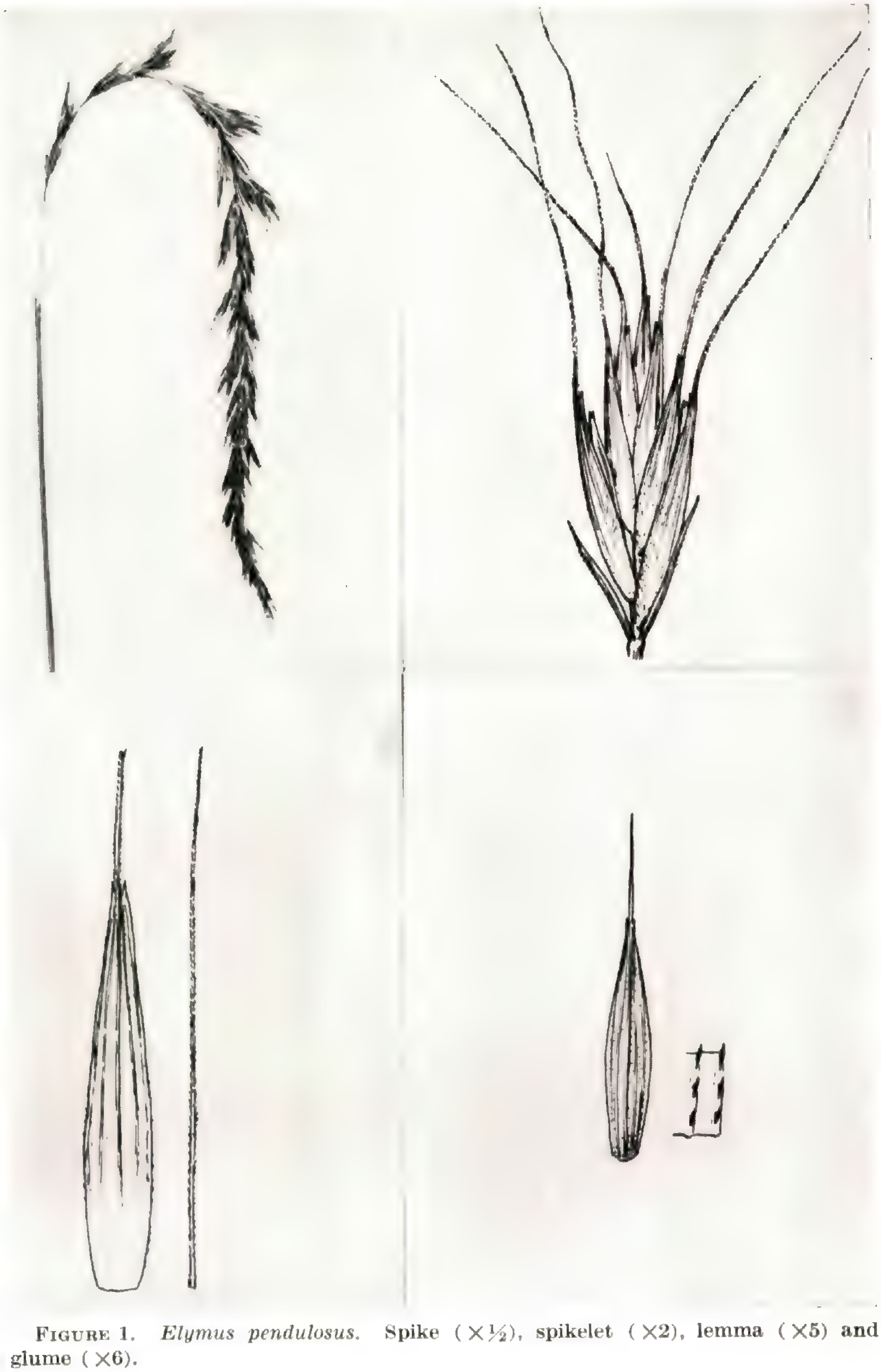

Figure 1. *Elymus pendulosus.* Spike (×½), spikelet (×2), lemma (×5) and glume (×6).

not observed. It also has been observed along the Alaska Railroad right-of-way northward from the Matanuska Valley though the northern limit of its range in this direction is unknown. It has not been observed in the Fairbanks area.

Throughout its range it is confined generally to habitats such as borrow pits and highway shoulders and embankments. In these situations it appeared where competition from other species was not sufficient to limit its occurrence and spread. Several colonies were located near Fish Creek. Here it occurred in openings of birch, alder and poplar thickets along the banks of the Knik Arm. Numerous colonies occurred on ledges and escarpments along the Lowe River which flows into Prince William Sound at Valdez. Its common occurrence in the gorge a few miles east of Valdez, and the colonies at Fish Creek, were in situations that precluded further consideration of the plant as a recently introduced exotic as had been the writer's earlier opinion. Here the species gave the appearance of being native to the flora.

The table below gives measurements and descriptive data derived from a mass collection consisting of 47 specimens made throughout the range of the species.

Figure 1 depicts a typical spike, spikelet, lemma, and glume of *Elymus pendulosus*.

The description is based upon measurements and other in-

| | | *Mean ± S. D.* | *Range* | *Description* |
|---|---|---|---|---|
| Lemma | length mm. | 12.2 ± 1.2 | 9.5 – 14.2 | 5-nerved, strongly nerved upper 2/3, short- |
| | width mm. | 1.8 ± 0.2 | 1.3 – 2.2 | pubescent at base |
| | awn mm. | 20.3 ± 4.0 | 11.5 – 31.0 | |
| Palea | length mm. | 11.7 ± 1.1 | 9.4 – 14.6 | toothed, weakly scabrous on edges |
| | width mm. | 1.1 ± 0.1 | 0.7 – 1.5 | |
| Glume | length mm. | 5.8 ± 1.0 | 4.1 – 8.0 | very narrow scarious margin, linear- acuminate, |
| | width mm. | 0.7 ± 0.2 | 0.5 – 1.0 | 2–5 nerves |
| | awn mm. | 3.0 ± 1.3 | 0.5 – 7.0 | |
| Anther | length mm. | 1.7 + 0.1 | 1.4 – 1.9 | |
| Culm | length cm. | 66.0 ± 11.7 | 42.2 – 98.4 | |
| Spike | length cm. | 22.6 ± 3.2 | 14.8 – 29.0 | pendant |
| | width mm. | | 10.0 – 20.0 | |
| Rachilla | | | | short-pubescent |

formation derived from specimens taken throughout the entire range of the species, as well as casual field observations. The type specimen, H. J. Hodgson No. 234, was taken near Palmer, Alaska on July 29, 1955. This is deposited in the U. S. National Herbarium, Smithsonian Institution, Washington.

Cotype specimens have been deposited in various herbaria as follows: No. 230, University of California (Berkley); No. 231, Missouri Botanical Garden (St. Louis); No. 233, New York Botanical Garden; No. 235 Department of Agriculture, Ottawa, Canada; and No. 236, University of Wisconsin (Madison).

Other specimens have been deposited in the Herbarium of the University of Alaska, Fairbanks, Alaska.

*Elymus pendulosus* is a 28-chromosome species as is generally true of *E. canadensis*. Meiosis is predominately regular with almost all diakinesis figures showing 14 bivalents. Bridges occurred in about 10 per cent of the Anaphase I figures examined. About 75 per cent viable pollen is produced by this species. The cytology of this species and its presumed hybrids with *Agropyron sericeum* Hitch. will be presented in a later paper.

The author takes pleasure in expressing appreciation to Dr. Etlar L. Nielsen for reviewing the manuscript and for his constructive criticisms, to Mr. Jason R. Swallen for reviewing the manuscript and assisting with the latin description and to Mrs. E. Herbold Froeschner for the line drawings in figure 1.

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# SOME NEW PRIMITIVE MEXICAN CRUCIFERAE

Reed C. Rollins

Present day phylogenists will readily admit the *Cruciferae* and the *Capparidaceae* to adjacent rungs on the phylogenetic ladder of the higher plants even though they may not agree in detail as to the point of origin of each family. For some time it was contended that the *Cruciferae* arose from some prototype plant somewhat similar to certain taxa of the *Papavaraceae*, but evidence has been piling up in favor of the view that the *Cruciferae* arose from some capparidaceous-like plant and that the two families probably had a common origin (von Hayek, 1911; Schulz, 1936). Certainly there are genera of the two families

with marked similarities. Both *Warea amplexifolia* and *Stanleya pinnata*, for example, were originally described in the *Capparidaceae* as species of *Cleome*. Those who stress the similarities of these families usually point to the presence in the *Cruciferae* of characters such as a gynophore and spreading equal stamens, which are regular features of the *Capparidaceae* (cf. Rollins, 1939). These characteristics are by no means common in the *Cruciferae* but among genera of the Western Hemisphere they may be found in *Warea*, *Stanleya*, *Thelopodium*, *Romanschulzia* and a few others.

In the past, *Stanleya* has been thought of particularly as being a key to the phylogenetic link between these two families. Now as *Romanschulzia* is becoming better known, this genus may be viewed with increasing interest in this connection. *Stanleya* occurs only in the arid areas of western North America and appears to be somewhat isolated morphologically from most other crucifers. It ties in with *Thelypodium* but appears not to have any other close connections. This is not the case with *Romanschulzia*, because it ties in with *Thelypodium* in one direction and with *Sisymbrium* in another. Furthermore, it is not too distant from a genus like *Macropodium* of eastern Asia. The broad, flattened and reflexed siliques of *Romanschulzia apetala*, together with the long gynophore, the spreading exserted stamens and the greatly elongated inflorescence, particularly suggest such a relationship. Because of the increasing evidence that *Romanschulzia* may occupy a key phylogenetic position among primitive crucifers, the new material coming from Mexico and Central America is of high interest. However, the paucity of collections of this genus still does not permit a proper assessment of it in terms of the phylogeny of the family as a whole. The three species described below are clearly distinct from the eight species covered in my former treatment of the genus (Rollins, 1942). It is hoped that the illustrations of them will aid collectors in procuring more material of this interesting genus.

**Romanschulzia Meyerii** Rollins, sp. nov.

Perennial from a deep root; stems up to 2 meters high, branched above, glabrous, pithy; basal leaves petiolate, runcinately pinnatifid to pinnately lobed, 1–2 dm. long including petiole, blade extremely thin and fragile, veins prominent, pubescent with sharp flat awl-shaped trichomes which

Fig. 1–4, *Romanschulzia Meyeri*. Fig. 1, basal portion of plant with basal leaves, × ½. Fig. 2, central portion of stem with auriculate cauline leaves, × ½. Fig. 3, upper portion of an infructescence, × ½. Fig. 4, basal portion of a silique showing gynophore, × 3. Drawings by Dorothy H. Marsh.

occur mostly along the veins and blade margins, lobes irregular, terminal lobe making up most of the blade surface, oval to nearly orbicular, irregularly dentate, incised or somewhat erose, lateral lobes remote and small, usually oblong, petiole variable in length, 5–15 cm. long; cauline leaves auriculate, clasping, thin, broadly oblong, obtuse or the upper pointed, prominently veined, glabrous or with an occasional trichome arising near a vein, reduced upwards, 1–2 dm. long, 3–8 cm. wide, margin smooth or with minute callosities which project very slightly; infructescence greatly elongated, 3–7 dm. long; pedicels spreading at right angles to descending, expanded at apex, glabrous, 7–12 mm. long; siliques terete, somewhat moniliform, stipitate, widely spreading, usually curved upward, rarely nearly straight, 6–10 cm. long, 1–1.2 mm. in diameter, glabrous, valves nerved from base to apex; gynophores 1.5–2.5 mm. long; styles slender, unexpanded at apex, 1–1.5 mm. long; seeds uniseriate, alternating on each side of the septum resulting in a marked displacement of the septum into the opposite valve, seeds plump, oblong, ca. 1.5 mm. long, < 1 mm. in diameter, with well defined but not high longitudinal ribs, circular scar at the funicular end prominent, radical shorter than the cotyledons; cotyledons incumbent, thick. Fig. 1–4.

Herba perennis robusta; caulibus glabris superne ramosis teretibus ad 2 m. altis; foliis radicalibus petiolatis lyrato-pinnatifidis membranaceis pubescentibus 1–2 dm. longis; foliis caulinis sessilibus integris auriculatis amplexicaulibus late oblongis obtusis glabris 1–2 dm. longis, 3–8 cm. latis; infructescentiis 3–7 dm. longis; pedicellis fructiferis patentibus glabris 7–12 mm. longis; siliquis glabris teretibus moniliformibus stipitatis 6–10 cm. longis; stylis tenuibus 1–1.5 mm. longis; seminibus oblongis ca. 1.5 mm. longis, cotyledonibus incumbentibus.

Type in the Gray Herbarium, collected along a dry stream at an altitude of 1900 meters on the east side of Cerro Linadero, Dulces Nombres, Nuevo León, just east of border into Tamaulipas, 24° N., 99.5–100.5° W., Mexico, August 9, 1948, *F. G. Meyer and D. J. Rogers 2892.* Isotype at the Missouri Botanical Garden.

This species possesses by far the longest siliques known in the genus and even though they are mostly above seven centimeters long, they show a marked tendency to curve upwards, being most frequently bow-shaped. The pedicels are widely spreading from a position nearly at right angles to somewhat reflexed, but remaining always at a wide angle of divergence from the rachis. There are no flowers present on the specimens.

*Romanschulzia Meyerii* appears to be most closely related to *R. elata*, but there is so little material available of these species that it is impossible to be sure where the relationship lies. *R. Meyerii* also has a number of characteristics in common with *R. turritoides*. The very long arcuate siliques of *R. Myerii* are

distinctive and indicate that it is without doubt an independent species.

**Romanschulzia subclavata** Rollins, sp. nov.

Herbaceous perennial (?) basal portion unknown; stems up to 2 meters high, branched above, hirsute with short awl-shaped trichomes below, sparsely pubescent above; cauline leaves auriculate, clasping the stem, lanceolate, acute to acuminate, shallowly dentate to denticulate, some leaves with a pair or several larger teeth toward the base of the blade, greenish above, slate-colored below, often somewhat narrowed toward the base, 6–15 cm. long, 1–2 cm. wide, sparsely hirsute to glabrous; infructescence up to 10 dm. or more long, narrow; pedicels glabrous, spreading at right angles to rachis to very slightly ascending, 5–15 mm. long; flowers numerous in a long raceme; sepals oblong, white to slightly purplish, adjacent sepals united below into pairs, 3–4 mm. long, 1.5–2 mm. wide; petals absent; stamens nearly equal, spreading at anthesis, filaments slightly flattened, white, expanded at base, anthers 1.8–2 mm. long; siliques linear to somewhat subclavate, erect, nearly terete, stipitate, glabrous, 1.5–2.5 cm. long, ca. 1.5 mm. broad, valves with a single nerve from base to apex; gynophore 1.5–2 mm. long; pollen tricolpate, reticulately pitted, narrowly oblong, 24.14 × 13.13 (av. of 10 grains); styles slender, 0.5–1 mm. long, unexpanded at apex; immature seeds wingless, oblong, plump, ca. 2 mm. long; ca. 1 mm. wide, forming a single row in the siliques. Fig. 5A-D.

Herba perennis (?) basi ignota; caulibus superne ramosis teretibus pubescentibus vel glabris 1–2 m. altis; foliis caulinis auriculatis amplexicaulibus lanceolatis acutis vel acuminatis dentatis vel denticulatis sparse hirsutis vel glabris 6–15 cm. longis, 1–2 cm. latis; inflorescentiis 6–10 dm. longis; pedicellis patentibus glabris 5–15 mm. longis; sepalis oblongis, albis, 3–4 mm. longis, 1.5–2 mm. latis; petalis absentibus; siliquis subclavatis vel linearibus teretibus stipitatis glabris 1.5–2.5 cm. longis; stylis tenuibus 0.5–1 mm. longis; seminibus immaturis oblongis ca. 2 mm. longis, ca. 1 mm. latis.

Type in the Gray Herbarium, collected on Mt. Tancitaro in the Municipality of Tancitaro, Michoacán, Mexico, July 25, 1941, *Wm. C. Leavenworth and H. Hoogstraal 1207.* The site is noted as "just above cloud forest on exposed ridges" at an elevation of 9,500 ft. A second specimen from the same area has the following label data: "plant 5 ft. tall, straight, white flowers; damp cliffs in cloud forest, Mt. Tancitaro, 10,000 ft., July 9, 1941, *Wm. C. Leavenworth and H. Hoogstraal 4034.*" (GH).

**Romanschulzia schistacea** Rollins, sp. nov.

Perennial or possibly biennial; stems relatively slender, 5–8 dm. high, glabrous, simple or branched; basal leaves not present; cauline leaves thin, over-lapping, auriculate, clasping the stem, green above, slate-colored beneath, glabrous or with a few scattered trichomes, 4–10 cm. long, 1.5–3.5 cm. wide, narrowly oblong to nearly lanceolate, broadest

FIG. 5A–D, *Romanschulzia subclavata.* Fig. 5A, upper portion of plant showing inflorescences, × ½. Fig. 5B, flowers at full anthesis, semidiagrammatic, × 5. Fig. 5C, flower at the beginning of anthesis, semidiagrammatic, × 5. Fig. 5D, silique, pedicel and area of attachment to stem, × 1.5. Drawings by B. Tugendhat.

above middle, only slightly to rather markedly narrowed toward base, acute to acuminate, entire, denticulate with minute teeth along margins, midvein prominent; infructescence relatively short, 1–2 dm. long; flowers not numerous, about 12–36 in each inflorescence; pedicels spreading, expanded into receptacle, 6–10 mm. long; sepals caducous, yellowish white, nonsaccate, glabrous, 3–4 mm. long; petals linear, widely spreading at anthesis, not differentiated into blade and claw, yellowish-white, 4–5 mm. long, 0.5 mm. or less wide, only slightly narrowed below; stamens spreading at anthesis, nearly equal, filaments ca. 4 mm. long, expanded at base, anthers 1.5–2 mm. long; pollen tricolpate, reticulately pitted, narrowly oblong, 29.18 × 12.54 (av. of 10 grains); glands well developed around the stamens and petals and forming a disc around the ovary; siliques stipitate to nearly sessile, glabrous, terete, somewhat constricted between the seeds, widely spreading, curved upward, 2.5–3.5 cm. long, < 1 mm. in diameter, lowest portion sterile and resembling a gynophore, valves without a prominent nerve; gynophore 0.5 mm. long to nearly wanting; style slender, unexpanded at apex, 1–1.5 mm. long; immature seeds oblong, in a single row in the silique. Fig. 6A-D.

Herba perennis (?) caulibus tenuibus glabris simplicibus vel ramosis 5–8 dm. altis, foliis radicalibus ignotis; foliis caulinis sessilibus auriculatis amplexicaulibus imbricatis oblongis vel lanceolatis integris denticulatis acutis vel acuminatis 4–10 cm. longis, 1.5–3.5 cm. latis; pedicellis fructiferis patentibus glabris tenuibus 6–10 mm. longis; sepalis caducis glabris 3–4 mm. longis; petalis patentibus ochroleucis linearibus 4–5 mm. longis, 0.3–0.5 mm. latis; siliquis teretibus patentibus glabris 2.5–3.5 cm. longis stipitatis, seminibus uniseriatis.

Type in the Gray Herbarium, collected in moist woods, Barranca de las Verduras, north side of El Monte on trail from Zimapan to Mines of El Monte, August 11, 1948, *H. E. Moore, Jr. and C. E. Wood, Jr. 1945.* Isotype at the Bailey Hortorium.

This taxon has a shorter inflorescence than most species of *Romanschulzia*, approaching some specimens which I have determined as *R. arabiformis* in that respect. However, the widely spreading, upcurved, relatively long siliques are distinctive. The seeds are definitely uniseriate in *R. schistacea* and the sepals lack the horn-like thickening at the apex, as found in *R. arabiformis*. The slender yet prominent styles are not common characteristics of any closely related species in the genus. The leaves are exceedingly thin and fragile. *R. schistacea* lies about as close to *Sisymbrium* as any species of *Romanschulzia* and were it not for the spreading petals, the equal and spreading stamens, and the caducous calyx, I should be inclined to place it in that genus.

Fig. 6A–D, *Romanschulzia schistacea.* Fig. 6A, plant with basal leaves missing, × ½. Fig. 6B, silique, pedicel and area of attachment, × 2. Fig. 6C, flower at the beginning of anthesis, × 5. Fig. 6D, flower at full anthesis, × 5. Drawings by B. Tugendhat.

### **Romanschulzia apetala** Rollins

The original description of this species was based on a single flowering specimen. Since then, a second collection made by Richard W. Holm and Hugh H. Iltis in 1949 in the general area of the type locality, has been available for study. Fortunately,

part of an old raceme of fruits is included as part of the specimen preserved at the Missouri Botanical Garden. These are the first fruits I have seen of *R. apetala* and they are unique in the whole genus in being broad, flattened, and with a relatively long slender style. As predicted from the flowering material, the pedicels are somewhat reflexed although they are not strictly so. The flat siliques are tapered both above and below into a more or less lanceolate shape. However, the body of the silique has roughly parallel sides. The fertile portion of the silique is 3–4 cm. long and 3.5–4.5 mm. wide; the gynophore varies from 5–8 mm. long; and the slender style is 4–5 mm. long.

The data from the label of this specimen are as follows: loose shrub up to 3 m. tall; flowers dark purple; disk after dehiscence of sepals prominently whitish green; young stamens purple. Virgin cloud-forest, 3000–3300 m., vicinity of Millsville, Pan-American Highway, about 3 km. above Nivel, Province of Cartago, Costa Rica, 22 July 1949, *Holm and Iltis 536* (MO).

**Sisymbrium Standleyi** Rollins, nom. nov., based on *Romanschulzia alpina* Standley and Steyermark, Fieldiana **24:** 377. 1946, not *Sisymbrium alpinum* Fourn., Recherch. Crucif. 131, 1865, which was based on *Braya alpina* Sternb. and Hoppe.

At the time I was studying *Romanschulzia* previously (l. c.), I put aside an undetermined specimen collected by Alexander F. Skutch from the Department of Quezaltenango in Guatemala that represented an undescribed species of *Sisymbrium*. The material was considered for possible inclusion in *Romanschulzia* since the cauline leaves are auriculate, but the flowers do not have the equal spreading stamens, the caducous calyx, nor the gynophorate siliques of *Romanschulzia*. In the meantime, Standley and Steyermark have described *R. alpina* based on specimens collected by Steyermark in the Department of Huehuetenango, Guatemala. Now a comparison of the type of *R. alpina* with the Skutch collection shows that they belong to the same species. The species is not closely related to any in *Romanschulzia* and does not possess the essential characters of the genus. On the other hand, it is related to species included in *Sisymbrium* by Payson and others, where it is best placed, pending further studies of that genus. The known collections, all from Guatemala, referable to *Sisymbrium Standleyi* are as

follows: dry, rocky, grassy slopes, between Tojquiá and Caxín Bluff, summit of Sierra de los Cuchumatanes, Dept. of Huehuetenango, Aug. 6, 1942, *Julian A. Steyermark 50144* (F, type); near Tunimá, Sierra de los Chuchumatanes, July 6, 1942, *Steyermark 48923* (F); Volcán Santa María, Dept. Quezaltenango, July 27, 1934, *A. F. Skutch 864* (GH).—GRAY HERBARIUM, HARVARD UNIVERSITY.

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# CLARENCE HINCKLEY KNOWLTON

Ralph C. Bean

The New England Botanical Club has had in its membership through the years many enthusiastic amateur botanists, men in business or professional life who have gained physical vigor and intellectual enjoyment in their botanical pursuits. Perhaps none of these has been so active in the Club for so long a period as Mr. Clarence Hinckley Knowlton who died May 10, 1956 at the South Shore Hospital in Weymouth, Massachusetts.

Mr. Knowlton was born in Farmington, Maine September 9, 1876, the son of David Hunter Knowlton and Clara Armine (Hinckley) Knowlton. His father was the publisher of the local paper and had a job printing business in Farmington. There Mr. Knowlton began to study plants and for many years he collected in Farmington and the surrounding towns. Day Mountain, Mount Abraham and Mount Saddleback, all in Franklin County, stimulated his early interest in unusual plants. Even after he had established his home in Massachusetts he would return to Farmington to search for plants which might have escaped his attention in his earlier collecting.

Mr. Knowlton's preparation for college was at the Farmington

State Normal School. He entered Harvard in 1895 and graduated in the Class of 1899. After graduation he engaged in teaching for more than six years in Massachusetts. He was one year at Webster, for three years he was principal of the Chelmsford High School and from 1903 to 1905 he was submaster at the High School in Lexington. During these years he explored the local flora most thoroughly as the many sheets in the New England Botanical Club herbarium show.

After these years in teaching he became interested in the book publishing business and early in 1906 he began work in the Boston office of D. C. Heath and Company, publishers. He remained with them for more than forty years until his retirement in 1949. For the first two and a half years he worked in the manufacturing department and thereby acquired a thorough knowledge of the books which the company published. Then he was sent out as an agent. From time to time he did editorial work as well. As a result of his business contacts he came to have a large acquaintance with the schoolmen of New England. He was one of the founders and the first secretary of the Educational Salesmen's Association of New England, an organization which brought men of like interests together and did much to ameliorate the asperities of competition in the school book and supply business.

On September 1, 1907, Mr. Knowlton married Lydia Anne Hunter of Machias, Maine whose father was a physician in Machias for many years. From that time on he spent part of his vacation each year at his summer home at Roque Bluffs, near Machias, and collected extensively in Washington County in which both Machias and Roque Bluffs are located. In 1907, he published in Rhodora "Noteworthy Plants collected at Roque Bluffs, Maine" and in 1917 "Plants and Plant Societies at Roque Bluffs, Maine." Unfortunately the Flora of Washington County on which he had spent so much time was never published. However, his specimens are in the herbarium of the New England Botanical Club.

After his marriage, he made his home at Hingham, Massachusetts where both Mr. and Mrs. Knowlton entered wholeheartedly into all phases of the life of the community. Mr. Knowlton was active in the First Church (founded in 1635) serving as the first president of the Unitarian Layman's League

Chapter and chairman of the Parish Committee. In Hingham he served as president of the Hingham Chamber of Commerce and had been treasurer of the Hingham Historical Society since its incorporation in 1914. He took a deep interest in the Historical Society building, the Old Ordinary, and in the collections which it housed. Another Hingham interest was the South Shore Nature Club of which he was one of the most active members and of which he was president for four years. Several publications of this organization were written by Mr. Knowlton such as "The Goldenrods of the South Shore," " The Asters of the South Shore" and "The Trees of the South Shore."

Mr. Knowlton was elected one of the Trustees of Public Reservations and prepared a "Flora of the Rocky Woods Reservation" at Medfield, Massachusetts while serving in that capacity. He was an associate member of the American Association for the Advancement of Science and a member of the Boston City Club. It is clear that his greatest interest always remained in the field of botany. He became a member of the New England Botanical Club in 1900 and was closely connected with its various activities for over fifty years. He served as president for three years (1925 to 1928), as chairman of the Program Committee, a member of the Committee on the Local Flora, a member of the Committee on Plant Distribution, a member of the Committee on the Flora of Massachusetts, and a member of the Committee on the Flora of the Boston District. He was a member of the Vermont Botanical Club and of the Josselyn Botanical Society of Maine. For many years he was treasurer of the latter society, attending the field meetings and contributing to the programs. In this connection it is interesting to note that the Josselyn Botanical Society held a meeting in Farmington in 1896 which Mr. Knowlton attended and again fifty seven years later in 1953 there was a second field meeting at Farmington where Mr. Knowlton was of great help because of his intimate knowledge of the area. This was his last field meeting with the Society.

In the course of the years, Mr. Knowlton made some collecting trips outside of New England though the latter area held his life interest. In 1930, with Mrs. Knowlton, he spent the summer in England which enabled him to attend the International Botanical Congress at Cambridge.

In 1911 in connection with his business, Vermont and western

New Hampshire were added to his collecting territory. When he began to make his business trips by automobile he also explored the areas he visited for botanical specimens. Many of the duplicates were given to the New England Botanical Club and finally in 1955 he presented his entire herbarium to the Gray Herbarium with the stipulation that the Club was to have any New England specimens needed. He was always alert in finding new plants and in learning about the plants themselves, their distribution and their relation to the soil and habitat. Many botanists have pleasant memories of days in the field with him.

Mr. Knowlton through the years contributed many articles to Rhodora. Two such appear in 1899 in the first volume and his last contribution is appearing in the current volume in 1956.—

WAKEFIELD, MASSACHUSETTS.

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Dentaria multifida in Central Ohio—In the spring of 1914 *Dentaria multifida* Muhl. was first collected in Delaware County, Ohio by Dr. C. E. O'Neal and his student, the late Dr. R. C. Friesner. This station is an undisturbed, rich elm-oak-maple woodland locally noted for its abundance of spring wildflowers. The soil is slightly acidic clay loam. A specimen was later deposited by O'Neal at the Herbarium of Ohio State University.[1] This record was overlooked by later authors, however, and thus the species is represented as being restricted to an area bounded by Georgia and Alabama on the south and the extreme southern portions of Ohio and Indiana on the north.[2]

During the spring of 1955 a second station was discovered by the writer near the top of a ridge bordering Alum Creek approximately seven miles north of the original collection. Here the plants were growing closely associated with *D. laciniata* Muhl. and *D. diphylla* Michx.

The distribution of *D. multifida* is an interesting problem in plant geography. Delaware County was covered by the Wisconsin ice sheet and plants must have come in after the final retreat of the glacier. But evidently northward migration

[1] Schaffner, John H. 1932. Revised Catalogue of Ohio Vascular Plants. Ohio Biological Survey **5**: 89–215.

[2] Fernald M. L. 1950. Gray's Manual of Botany, 8th Edition, American Book Co.

of this species has been very limited, for the nearest recorded collection is from unglaciated Morgan County, in Southeastern Ohio. Montgomery[3] has shown that species of *Dentaria* belong to a sexually sterile, polyploid series. One can only speculate as to how this isolated, northern population became established.

The data for the original collection are as follows:—wooded ravine along brook tributary to Alum Creek, 7.1 miles east of Delaware, near U. S. Route 36, Delaware Co., Ohio, May 12, 1931, *C. E. O'Neal.* Specimens from both areas are deposited in the Herbarium of Ohio Wesleyan.—Robert W. Long, Jr., dept. of botany, ohio wesleyan univ., delaware, ohio.

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A Correction in the Names of Two Species of Heterokontae—The genus *Radiosphaera* Pascher (1939, p. 549) of the order Heterococcales has recently been shown to be invalid by the careful work of Starr (1955, p. 48). Accordingly its two species *R. sol* Pascher and *R. Nemiahi* Croasdale must be placed in a validly published genus. Pascher, in 1932, considering *Radiosphaera* a subgenus, classified his species *R. sol* in the genus *Meringosphaera* Lohmann (1903, p. 68), to which it can most naturally be returned. Likewise *R. Nemiahi* can best be assigned to this more inclusive genus, differing, with *M. sol,* from other species only in the more or less aequatorial distribution of the spines. The following changes are therefore made:

*Meringosphaera sol* Pascher 1932, p. 208, Fig. 14 (*Radiosphaera sol* Pascher 1939, p. 550, Fig. 404).

*Meringosphaera Nemiahi* comb. nov. (*Radiosphaera Nemiahi* Croasdale 1948, p. 279, Pl. 1118, Fig. 8).

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—Hannah Croasdale, dept. of zoology, dartmouth college, hanover, n. h.

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Elodea Correct without Being Conserved.—In the 8th edition of Gray's Manual, the generic name *Elodea* Michx. (Fl. Bor.-Am. **1:** 20, 1803) is retained with the statement "proposed for conservation," being supposedly a later homonym of *Elodes* Adans. (Fam. Pl. **2:** 444, 1763), or *Elodea* Adans. ex Jussieu (Gen. Pl. p. 255, 1789), or *Elodea* Adans. ex Vent. (Tabl. Règne Vég. **3:** 144, 1799). At the time the problem was discussed by C. A. Weatherby ("On the nomenclature of *Elodea*," Rhodora **34:** 114–116, 1932), *Elodes* and *Elodea* were considered variant spellings of the same name, and Michaux' genus had then to be called *Anacharis*. But as since modified, the rules treat the words as different names (International Code, 1952, Art. 82, paragraph 4 of examples after note 4). With support from this fact, we may consider *Elodea* as used by Jussieu and Ventenat merely an orthographic error (cf. paragraph 3 of examples under Art. 82). By the former author it was mentioned only as a synonym, since he lists it under *Hypericum* with the comment that the genus "is perhaps to be divided into several, which are *Ascyrum* Tourn., *Hypericum* Tourn., *Androsaemum* Tourn., *Elodea* Adans., *Knifa* Adans." Ventenat was merely elaborating Jussieu's classification (the subtitle of his work is "Selon la Méthode de Jussieu"), and although *Elodea* appears as a distinct genus, it is not published as new, but is still credited to Adanson. Since this is clearly an orthographic error, the first valid publication of the generic name *Elodea* is that of Michaux, which therefore does not need to be conserved. It may be mentioned that *Elodea* is used in such recent critical European floras as Clapham, Tutin and Warburg's *Flora of the British Isles* (1952) and Nils Hylander's *Nordisk Kärlväxtflora* (1953).—Lloyd H. Shinners, southern methodist university, dallas, texas.

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# Rhodora

JOURNAL OF

THE NEW ENGLAND BOTANICAL CLUB

**Vol. 58** **July, 1956** **No. 691**


## A CYTOTAXONOMIC STUDY OF THE GENUS HYMENOPAPPUS (COMPOSITAE)[1]


Billie L. Turner


*Hymenopappus*, an exclusively North American genus, has its greatest concentration of species in the United States. It has been conventionally placed in the tribe Helenieae of the family Compositae, a group of plants which is almost entirely North and South American. Of the 55 genera recognized for the tribe by Hoffmann (1897) in Engler and Prantl, only 3 occur on other continents. Thus the members of Helenieae should serve as excellent genera for monographic and evolutionary studies by American taxonomists, particularly since a considerable amount of the available herbarium material, including many types, may be obtained in this country. Equally, if not more important, is the opportunity for extensive field and cytogenetic work with members of the group. The genera in the tribe seem good subjects for chromosomal studies since both pollen mother-cell smears and root-tip squashes are easily made and excellent results are obtained. Since the naturalness of the tribe has been seriously questioned by Small (1919, p. 312) and more recently by Cronquist (1955), the accumulation of detailed knowledge of the included genera, particularly of evolutionary trends and chromosomal studies, is especially desirable.

Comparatively few genera of the Helenieae have been studied


[1] Part of a dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy at the State College of Washington. Post-doctoral field work was supported in part by the Plant Research Institute of the University of Texas.

monographically, much less cytotaxonomically, in recent years.[2] The completion of a larger number of such studies, combined with information from other tribes, particularly the Heliantheae, should provide much evidence on the affinities of the included genera and on the naturalness of the tribe as a whole.

In addition to this larger aspect of plant phylogeny and evolution, there are many problems at the specific level. Several genera of this tribe have occasioned considerable taxonomic confusion, particularly in the United States and Mexico. *Hymenopappus* is such a genus. The natural groups of this taxon have been treated in various ways. Gray (1886) recognized 7 species; Rydberg (1914), 28 species (including three of *Hymenothrix*); Johnston (1923), 14 species and one variety. The present account recognizes 25 taxa: 10 species, and 15 varieties (including one new species, and three new varieties).

Most of the shuffling and reshuffling of names has been in the *H. filifolius* complex, a group of closely related taxa distributed principally in the Rocky Mountains, Great Basin, and adjacent plains and deserts. These infraspecific units (as treated in the present paper) occupy more or less distinct habitats and are, for the most part, allopatric, although considerable overlap and intergradation often occurs peripherally with closely related taxa. This intergradation, combined with much spatial (but not altitudinal or ecological) overlap, has made the assembling of a great deal of herbarium material, seed for garden studies, and first hand field knowledge an absolute necessity for the understanding of the complex. The present treatment is an attempt to bring together this information so as to clarify many of the existing problems, as well as to show the relationships of the more easily recognized members of the genus. In general, the most valuable part of this information, aside from that obtained from herbarium specimens, has been obtained from field work and uniform garden cultures. Acquaintance with local and regional populations, their habitats, variability, and ranges, combined with later responses of representative individuals in the garden, has been invaluable. Chromosomal

[2] The following have been monographed or revised since 1930: *Chaenactis* (Stockwell, 1940); *Eriophyllum* (Constance, 1937); *Gaillardia* (Biddulph, 1944); *Hymenoxys* (Parker, unpubl.); *Monolopia* (Crum, 1940); *Palafoxia* (Baltzer, 1944); *Perityle* (Everly, 1947); *Schkuhria* (Heiser, 1945).

information has proved to be significant in relatively few taxa, though much remains to be done along this line, particularly in the *H. filifolius* var. *lugens* complex.

In some cases the problems raised by the author are more complex than those he attempted to solve, but remaining problems are few, and it is believed that the present treatment to a large extent places the individuals in natural groups from the standpoint of morphology, geography, ecology, and probably phylogeny.

## Historical Account

The genus *Hymenopappus* was proposed by L'Heritier in 1788 to accommodate *H. scabiosaeus*, a species grown from seed that had been collected in Carolina by Michaux and sent to Europe. The original publication consisted of only three pages, one of these being a plate.[3] Three years later Lamarck (1792) unaware of L'Heritier's description, redescribed the genus as *Rothia*, basing his name *R. caroliniensis* also on plants grown from seed collected by Michaux in Carolina.[4]

From 1788 until Gray (1886) treated the group in his Synoptical Flora of North America, seven of the ten species recognized in the present paper were described (one of these was included in the genus *Leucampyx*). Though Gray did not group the species of the genus into series, he clearly pointed out the distinctions of these groups in his key to species.

After Gray's treatment a number of new species were proposed; nearly all of these fell into the immediate vicinity of *H. filifolius*, a highly variable species-complex of the western United States. This period was climaxed by Rydberg (1914) who described four new species for the genus and recognized, in all, 28 species and no varieties. In addition, he confused generic limits by transferring three species of *Hymenothrix* to *Hymenopappus*.

[3] According to Britton and Woodward (1905) only a few of these sets ("monographs") were circulated, probably no more than five or twelve. In connection with the present study, two copies have been located, one in the library of the Linnaean Society in London, and the other in the library of the New York Botanical Garden.

[4] Kuntze (1891) thought that L'Heritier's genus did not appear until 1803, and argued that *Rothia* Lam. is the older name. Britton and Woodward (1905) give 1788 as the probable date for *Hymenopappus*. Since the generic name *Rothia* was already preoccupied at the time of Lamarck's publication, according to the International Code of Botanical Nomenclature (1952), *Hymenopappus* is the name to be used for the genus whether the date 1788 is correct or not.

Johnston (1923) gave a brief account of the genus in which he reduced most of the obvious relatives of *H. filifolius* to synonymy under that species. In many respects Johnston's treatment was like that of Gray, with the important exceptions of the reduction of *Leucampyx* to synonymy under *Hymenopappus* and the retention of *Hymenothrix palmeri* within the genus. The present treatment, at the specific level, is also like Gray's, but with several notable exceptions: *Leucampyx* is placed in synonymy under *Hymenopappus;* three species described as new since his time are considered to be valid; and *H. filifolius* has been treated as a species-complex composed of a number of recognizable geographic variants. In this latter respect this treatment is like that of Rydberg, most of his species being considered varieties in this paper. In addition, for the first time, a clear morphological distinction has been made between the genera *Hymenothrix* and *Hymenopappus.*

## Chromosomal Studies

Because of the apparent variability and wide distribution of the members of the genus *Hymenopappus,* it was thought early in this study that chromosomal information might be of considerable help in unraveling taxonomic problems. It soon became apparent, however, that the number $n = 17$ was constant for nearly all members of the genus, the exceptions being two tetraploid varieties or races within the *H. filifolius* complex.

Methods.—Collections of buds and/or seeds for chromosomal studies were made in the field during the summer of 1951.[5] Two different treatments were used for killing and fixing buds: either they were killed and fixed in Belling's modified Navashin's fluid directly (after removal of enclosing bracts), or they were fixed in Carnoy's fluid (9 parts absolute ethyl alcohol: 3 parts glacial acetic acid: 1 part chloroform) for 10 minutes then transferred to Navashin's fluid, a procedure suggested by Johansen (1940, p. 33). Buds collected in this manner were passed through a tertiary butyl alcohol series and embedded in paraffin. Sections were made at 15–20 microns, and the material stained with crystal violet. Prefixing of the material in Carnoy's

[5] Voucher specimens are deposited in the herbarium of the State College of Washington; collections made during 1954 and 1955 are in the University of Texas Herbarium.

fluid before transferring to Navashin's fluid gave best results, though, in general, neither treatment was very satisfactory for meiotic chromosomal studies. The bivalents tended to clump tightly together at metaphase obscuring individual chromosomes, although when meiotic material was found at late prophase good results were obtained.

Seeds collected in the field were grown in a uniform garden and pollen mother cell smears were made from these plants. Though the species of *Hymenopappus* are perennial and biennial, it was found that by germinating the seeds in the greenhouse during December and January and transplanting to the garden in spring, flowering could be induced the same year. Seeds germinated after January usually produced only rosettes the first year. Freshly collected buds from garden plants were placed on slides and the anthers removed to a drop of aceto-carmine where they were macerated with a glass rod. Since the chromosomes tended to clump at metaphase of meiosis, considerable pressure on the cover slip was required to spread them sufficiently for counting. Less pressure is needed at late prophase, and most of the counts and drawings were made at this stage. In addition to smearing fresh material directly, buds were also fixed in a modified Carnoy's fluid (4 parts chloroform: 3 parts absolute alcohol: 1 part glacial acetic acid) and stored under refrigeration, a method suggested by Walters (1952). Material collected in this manner takes a better stain with acetocarmine than does similarly stained fresh material. Buds may be stored for at least six months in the fluid with good results, and probably much longer.

Attempts to obtain counts and to determine chromosome morphology from root-tip material by standard embedding techniques was not rewarding. The root-tip chromosomes are extremely long, and because of their number ($2n = 34$), the metaphase plates appeared as a mass of interwoven chromosomes. However, excellent results were obtained in the latter part of this study through the use of a method suggested by Speese and Baldwin (1952). Seeds were germinated on moist filter paper and the primary radicles excised after they had emerged about 6 mm. These were placed in a saturated aqueous solution of paradichlorobenzene for two hours, washed in distilled

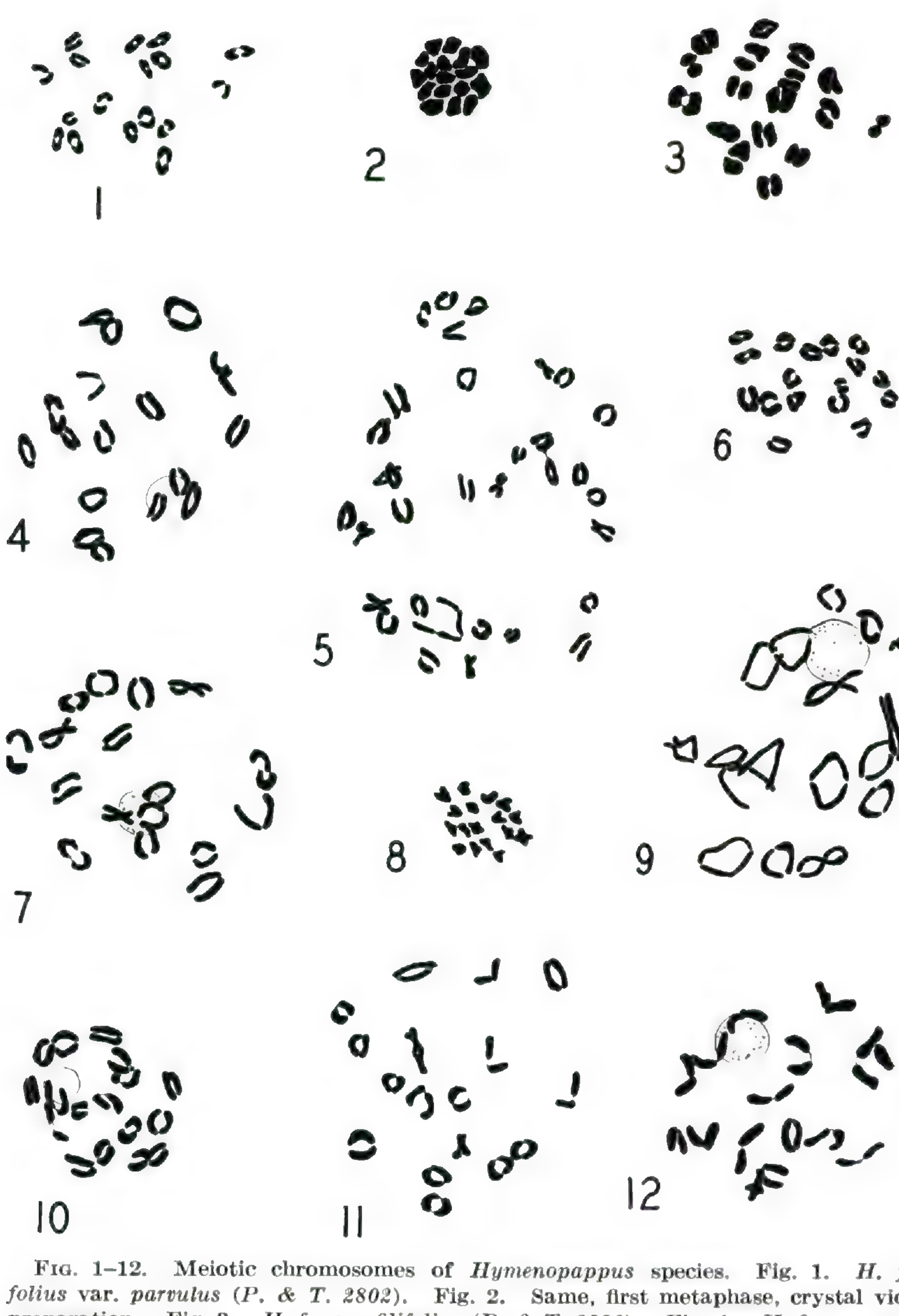


Fig. 1–12. Meiotic chromosomes of *Hymenopappus* species. Fig. 1. *H. filifolius* var. *parvulus* (*P. & T. 2802*). Fig. 2. Same, first metaphase, crystal violet preparation. Fig. 3. *H. f.* var. *filifolius* (*P. & T. 2293*). Fig. 4. *H. f.* var. *nanus* (*P. & T. 2608*). Fig. 5. *H. f.* var. *lugens*, white-flowered tetraploid race (*P. & T. 2666*). Fig. 6. Same, yellow-flowered diploid race (*P. & T. 2504*). Fig. 7. *H. newberryi* (*T. 2894*). Fig. 8. Same, second metaphase. Fig. 9. *H. filifolius* var. *cinereus* (*P. & T. 2830*). Fig. 10. *H. flavescens* var. *canotomentosus* (*P. & T. 2670*). Fig. 11. *H. tenuifolius* (*T. 2895*). Fig. 12. *H. scabiosaeus* var. *corymbosus* (S.V.F.). All × ca. 1000.

Fig. 13–20. Mitotic chromosomes of *Hymenopappus* species. Fig. 13. *H. filifolius* var. *cinereus* (*P. & T. 2754*). Fig. 14. *H. flavescens* var. *flavescens* (*Warnock;* Crane Co., Texas). Fig. 15. *H. filifolius* var. *nanus* (*P. & T. 2608*). Fig. 16. *H. f.* var. *lugens*, yellow-flowered diploid race (*P. & T. 2645*). Fig. 17. *H. f.* var. *luteus* (*P. & T. 2872*). Fig. 18. *H. f.* var. *polycephalus* (*S.V.F.;* Golden, Colorado). Fig. 19. *H. f.* var. *cinereus* (*P. & T. 2751*). Fig. 20. Same, chromosome set aligned and traced from Fig. 21. All × ca. 1250.

| TAXON | SOURCE | Chromosome Number P.M.C. | Root Tip |
|---|---|---|---|
| *H. artemisiaefolius* var. *artemisiaefolius* | TEXAS. Kleberg Co.: eastern Laureles Division of King Ranch, *M. C. Johnston 54411.* (This plant somewhat intermediate to *H. a.* var. *riograndensis*). | 17 | |
| | TEXAS. Colorado Co.: 5 mi. N.W. of Columbus, *Turner 3361.* | 17 | |
| *H. artemisiaefolius* var. *riograndensis* | TEXAS. Kleberg Co.: S. end of Canelo Pasture, Santa Gertrudis Division of King Ranch, *M. C. Johnston 54483.* | 17 | |
| | TEXAS. Hidalgo Co.: 5 mi. S. of Brooks County line, U. S. Highway 281, *M. C. Johnston 54528.* | 17 | |
| *H. filifolius* var. *cinereus* | COLORADO. Boulder Co.: 6 mi. N. of Boulder. *Q. Jones 835.* | | 34 |
| | *COLORADO. Chaffe Co.: 4 mi. W. of Salida, *Preece & Turner 2830.* | 17 | |
| | COLORADO. Gunnison Co.: Cimarron, *Preece & Turner 2793.* | | 34 |
| | COLORADO. La Plata Co.: 1 mi. N. of Durango, *Preece & Turner 2754.* | | 34 |
| | NEW MEXICO. Sandoval Co.: 7 mi. N.W. of Cuba, *Preece & Turner 2751.* | | 34 |
| | *NEW MEXICO. Santa Fe Co.: 3 mi. S.E. of Espanola, *Preece & Turner 2739.* | 17 | |
| | *NEW MEXICO. Santa Fe Co.: 4 mi. S. of Espanola, *Preece & Turner 2741.* | 17 | |
| *H. filifolius* var. *filifolius* | OREGON. Morrow Co.: 2 mi. W. of Boardman, *Ownbey & Preece 3366.* | 17 | |
| | OREGON. Wheeler Co.: 4 mi. E. of Mitchell, *Ownbey & Preece 3362.* | 17 | |
| | *WASHINGTON. Adams Co.: 12 mi. W.N.W. of Washtucna, *Turner 2293.* | 17 | 34 |
| *H. filifolius* var. *idahoensis* | IDAHO. Lemhi Co.: 14 mi. S. of Salmon, *Preece & Turner 2378.* | 17 | |
| *H. filifolius* var. *lugens* | *ARIZONA. Coconino Co.: 9 mi. E. of Peach Springs, *Preece & Turner 2610.* | 17 | |
| | *ARIZONA. Coconino Co.: 2 mi. E. of Ash Fork, *Preece & Turner 2618.* | 34 | |
| | ARIZONA. Coconino Co.: 7 mi. W. of Williams, *Preece & Turner 2628.* | | 68 |
| | *ARIZONA. Coconino Co.: 10 mi. S. of Flagstaff, *Preece & Turner 2645.* | 17 | 34 |
| | *ARIZONA. Coconino Co.: 5 mi. E. of Flagstaff, *Preece & Turner 2666.* | 34 | |
| | *ARIZONA. Yavapai Co.: 5 mi. W. of Seligman, *Preece & Turner 2614.* | 34 | |
| | *NEW MEXICO. Catron Co.: 35 mi. N. of Alma, *Preece & Turner 2710.* | 34 | |
| | NEW MEXICO. Catron Co.: 15 mi. N. of Alma, *Preece & Turner 2711.* | | 68 |
| | UTAH. Kane Co.: 3 mi. W. of Long Valley Junction, *Preece & Turner 2466.* | 17 | |
| | *UTAH. Kane Co.: 1 mi. S. of Glendale, *Preece & Turner 2504.* | 17 | |

| TAXON | SOURCE | Chromosome Number P.M.C. | Chromosome Number Root Tip |
|---|---|---|---|
| *H. filifolius* var. *luteus* | *WYOMING. Sweetwater Co.: 32 mi. S. of Green River, *Preece & Turner 2872.* | 17 | 34 |
| *H. filifolius* var. *nanus* | *ARIZONA. Mohave Co.: 6 mi. E. of Peach Springs, *Preece & Turner 2608.* | 17 | 34 |
| | UTAH. Washington Co.: 7 mi. S.W. of Shivwits, *Preece & Turner 2558.* | 17 | |
| *H. filifolius* var. *nudipes* | UTAH. Kane Co.: 15 mi. N. of Orderville, *Preece & Turner 2499.* | 17 | |
| *H. filifolius* var. *parvulus* | *COLORADO. Gunnison Co.: 15.6 mi. W. of Gunnison, *Preece & Turner 2802.* | 17 | |
| | COLORADO. Saquache Co.: dry hills near Elko, *Preece & Turner 2816.* | 17 | |
| *H. filifolius* var. *pauciflorus* | ARIZONA. Coconino Co.: 20 mi. S.W. of Marble Canyon, *Turner 3066.* | 17 | |
| *H. filifolius* var. *polycephalus* | COLORADO. Jefferson Co.: Golden, July 12, 1951, *Rev. S. V. Fraser.* | | 68 |
| | COLORADO. Larimer Co.: 1.5 mi. E. of Livermore, *Preece & Turner 2861.* | 34 | |
| *H. filifolius* var. *tomentosus* | UTAH. Washington Co.: Zion National Park, near lower entrance to road tunnel, *Turner 3065.* | 17 | |
| *H. flavescens* var. *cano-tomentosus* | *ARIZONA. Navajo Co.: 13 mi. S. of Holbrook, *Preece & Turner 2670.* | 17 | |
| | NEW MEXICO. Catron Co.: 8 mi. S.W. of Horse Springs, *Preece & Turner 2738.* | 17 | |
| *H. flavescens* var. *flavescens* | NEW MEXICO. Lea Co.: 2 mi. S. of Eunice, *Turner 2946.* | | 34 |
| | *NEW MEXICO. Lea Co.: 5 mi. N. of Eunice, *Turner 2947.* | | 34 |
| | *TEXAS. Crane Co.: sand between Crane and Odessa, June 15, 1952, *B. H. Warnock.* | | 34 |
| *H. mexicanus* | ARIZONA. Coconino Co.: 10 mi. N. of Flagstaff, *Preece & Turner 2634.* | 17 | |
| | *ARIZONA. Coconino Co.: 4 mi. S. of Flagstaff, *Preece & Turner 2641.* | | 34 |
| *H. newberryi* | COLORADO. Archuleta Co.: 1.5 mi. S.E. of Pagosa Springs, *Turner 2894.* | 17 | |
| | *NEW MEXICO. Sandoval Co.: Jemez Mts., 5 mi. S.E. of La Cueva, *Preece & Turner 2743.* | 17 | |
| *H. radiatus* | ARIZONA. Navajo Co.: 9.5 mi. N. of White River, *Preece & Turner 2686.* | 17 | |
| *H. scabiosaeus* var. *corymbosus* | *KANSAS. Cloud Co.: 2.5 mi. W. of Aurora, July 17, 1951, *Rev. S. V. Fraser.* | 17 | |
| | TEXAS. Austin Co.: 2.5 mi. N. of New Ulm, *Turner & Johnston 54333.* | 17 | |
| *H. tenuifolius* | NEW MEXICO. Santa Fe Co.: 14 mi. S. of Santa Fe, *Turner 2895.* | 17 | |
| | TEXAS. Coryell Co.: 3 mi. N. of Cooperas Cove, *Turner 3807.* | 17 | |
| | *TEXAS. Dallas Co.: Flagpole Hill, N. E. part of Dallas, *Beaman 519.* | | 34 |

* Collections grown in the garden are indicated by an asterisk (*).

water, and stored overnight in a modified Carnoy's fluid (3 absolute alcohol: 1 chloroform: 1 glacial acetic acid). Prior to squashing, the root-tips were hydrolyzed in acid alcohol (1 hydrochloric acid [sp. gr. 1.19]: 1 absolute alcohol) for 10–15 minutes and returned to the Carnoy's fluid. After 30 minutes to several hours the tips were removed and squashed in aceto-carmine. Staining of chromosomes was intensified when the slides were allowed to stand for one to three hours. Cover-slips were ringed with white Karo syrup for temporary mounts or made permanent by McClintock's method (1929).

Drawings were made with the aid of a camera lucida; in some instances mitotic chromosomes were spaced when these over-lapped.

Results.—No previous chromosomal counts have been reported for *Hymenopappus*. In the following list counts are given for 20 of the 25 taxa, including eight of the ten species in the genus. All the species of the genus investigated were found to have the base number of $x = 17$. Two varieties of *H. filifolius* are tetraploid or have tetraploid races: var. *polycephalus* ($n = 34$), and var. *lugens* ($n = 17, 34$).

Meiotic chromosomes at late prophase are comparatively short with similar morphologies and nearly always with two terminalized chiasmata. In all the collections from which meiotic counts were made, pairing appeared normal except in some of the tetraploid races of *H. filifolius* var. *lugens* where two or three quadrivalents were found consistently (*Preece & Turner 2614, 2618, 2666*).

Mitotic chromosomes are more distinctive, showing conspicuous differences in both length and centromere position. One chromosome pair with extended satellites is particularly outstanding, and has been found in the somatic cells of all collections of *Hymenopappus* so far examined. No attempt has been made to make extensive chromosomal comparisons within the genus, and it is possible that such study might reveal significant karyologic differences among the taxa.

Though chromosomal studies have not been of much help in showing relationships or affinities within *Hymenopappus*, they have shown that the members of the genus are held together naturally. This is particularly interesting with respect to

*H. newberryi* which was originally described as a different genus and placed in a separate tribe (Anthemideae). In the light of the chromosomal as well as morphologic evidence, there can be little doubt now that the species is properly placed in *Hymenopappus*.

## Genetic Tests

Methods.—Seeds collected during the summer of 1951 were germinated the following winter on moist filter paper in petri dishes and the seedlings grown in greenhouse pots. In spring these seedlings were transplanted to an outside garden. Ten plants of most of the collections were grown to maturity and the crosses indicated in Figure 21 attempted.

The plants were first tested for self-sterility by bagging portions of the inflorescence before anthesis. If seed failed to form in these bagged heads, it was assumed that the species was self-sterile.

Two methods were used in cross pollination: (1) the heads were bagged while in bud and after anthesis the pollen was blown or washed off and foreign pollen introduced by brushing an anther held in tweezers across the styles, and heads then rebagged; (2) peripheral florets were emasculated, foreign pollen introduced, and unpollinated florets removed before rebagging. In either case, if seeds with embryos developed the cross was interpreted as a successful one. It was found, in rare instances, that what were thought to be carefully bagged heads of self-sterile plants set one or two seeds whether foreign pollen was introduced or not, and it is suspected that some of the taxa are not completely self-sterile. Hence, successfully formed embryos as indicated in Figure 21 may not be an entirely accurate indication of crossability. In most instances, however, the crosses represent formation of several mature embryos per head.

*Results.*—All species tested were found to be self-sterile or nearly so except *H. newberryi* and *H. scabiosaeus* var. *corymbosus*. In general, it seems that crossing between the several species and varieties tested, so far as embryo development is concerned, occurs readily. Unfortunately, time was not sufficient to grow the supposed hybrid seeds to verify these assumptions, but the seeds have been saved for future study.

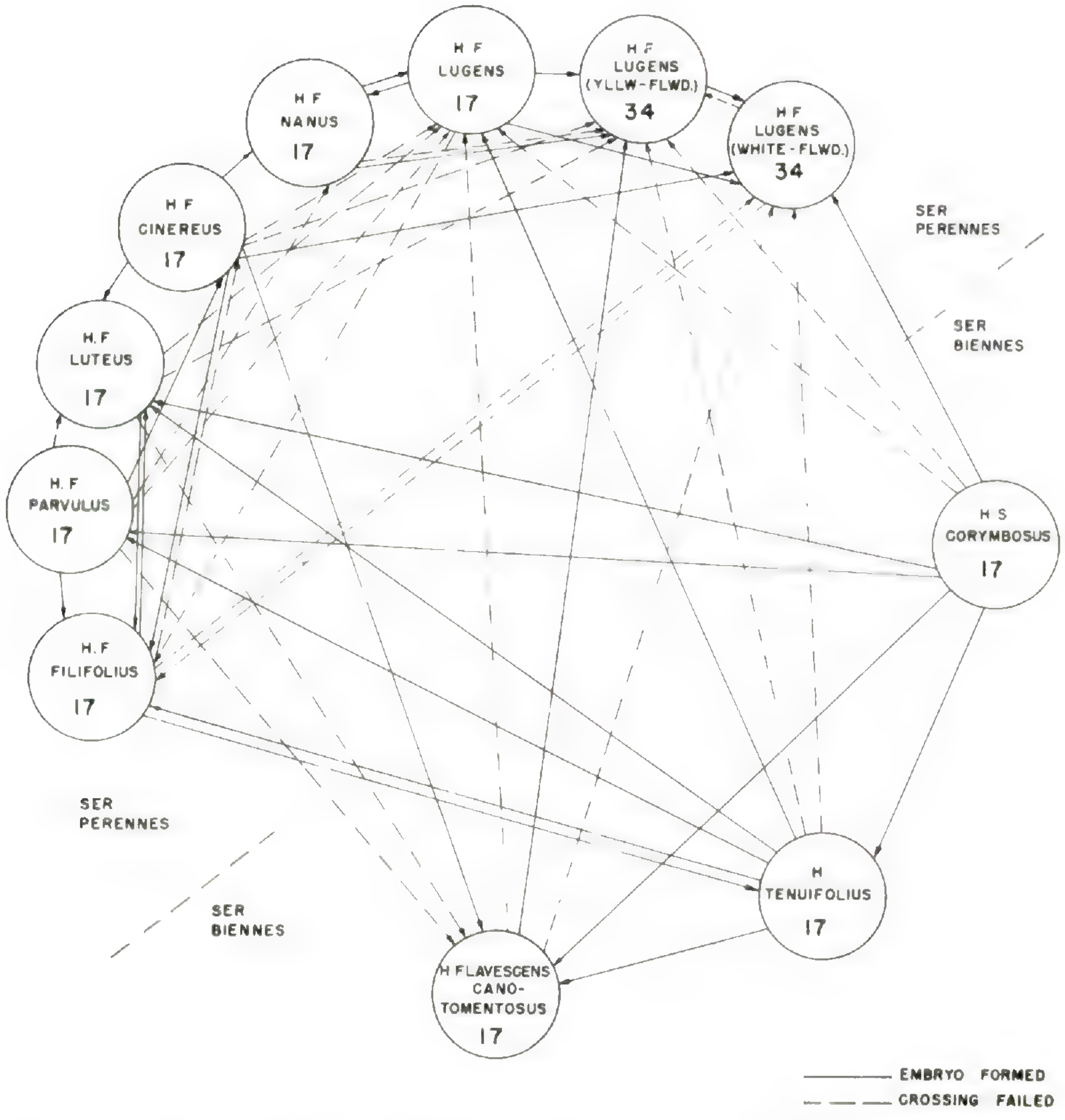


Fig. 21. Diagram of specific and varietal crosses attempted within *Hymenopappus*. Solid lines indicate successful production of mature seeds with embryos; dashed lines failure. Double lines show that the cross was attempted reciprocally. Arrows point to the female parent.

## Morphology and Taxonomic Criteria

It is difficult to assign values to particular characters, for a distinguishing character in one group may be a highly variable one in another. This is especially true at the varietal level where distinctions are usually made on a combination of features. The characters listed below were useful principally in the delimitation of specific categories; however, application in some instances could be made at the infraspecific level.

Habit.—Species of Series Biennes are tall, mostly leafy-stemmed biennials; those of Series Perennes tend to be lower, less leafy perennials.

Root.—Biennial species have a single obconical tap-root which normally bears but one crown at its apex. Perennial species have a woody tap-root which, in older plants, bears branches with several to many crowns.

Leaves.—Most of the species have pinnately compound leaves, although two species commonly have simple, entire leaves. The degree of leaf dissection and size of ultimate segments have been particularly useful in delimiting varieties.

Inflorescence.—In all the species the inflorescence is a few- to many-headed cymose panicle. Biennial species usually have several leafy lateral branches which contribute to the many-headed inflorescence; perennial species are usually without leafy lateral branches, the inflorescence being composed almost entirely of peduncles produced from the main stem.

Heads.—Radiate and discoid heads appear in species of both the biennial and perennial groups, the discoid type being much more common. In the discoid species the texture and size of the involucral bracts are often distinguishing.

Corolla.—The shape of the disk corolla, particularly that of the throat, has proved significant in several instances, both at specific and infraspecific levels. Two principal throat types are found in the biennial species: funnelform throats in the species of the eastern United States, and campanulate throats in the central and western species. In general, funnel-form-throated taxa also have long narrow tubes; campanulate-throated taxa have shorter tubes. The perennial taxa all have campanulate throats. The size of the throat varies considerably in the *H. filifolius* complex, but when correlated with other characters serves as a convenient marker.

Corolla color.—This character is an important one and should be included on collection labels when possible. A number of taxa can be separated by this feature alone, thus making a comparison of several combined characters unnecessary. There are two common flower colors in the genus, yellow and white. The perennial species are nearly all yellow-flowered, but a few varieties of *H. filifolius* have white flowers or white-flowered races. The biennial species are principally white-flowered, but include three yellow-flowered taxa. In addition, one taxon (*H. artemisiaefolius*) may have a reddish or wine-colored corolla.

Pubescence.—With some exceptions, pubescence has not proved to be of much significance. In the perennial species a dense tomentum or woolly mat of hairs is usually found in the axils of the basal rosette leaves. The biennial species are without this dense tomentum or, if it is present, it is of a lesser amount. Within the species or variety the overall pubescence varies considerably, and it is suspected that this is a result of environmental influences in some instances. Seeds collected in the field from tomentose-leaved specimens of *H. filifolius* var. *lugens* (*Preece & Turner 2710*), when grown in the garden at Pullman, Washington, produced plants with nearly glabrate leaves. Glandular hairs are found on the corolla tube in nearly all species of *Hymenopappus*, but have been of practically no use in circumscription of species or varieties. On the other hand, achenial pubescence seems to be relatively constant, and has been used in combination with other characters to delimit certain taxa.

Achenes.—The achenes are basically alike in the genus, differing principally in size, degree of pubescence, and length of pappus. In most species the achenes are obpyramidal with four sides, but in some there is a tendency for them to be incurved and diagonally compressed, especially at the periphery of the heads.

Style branches.—The styles are essentially alike in all the species, having obtuse flattened lobes with distinct marginal stigmatic lines on the upper surface and papillose tips.

## Measurements

Except in those taxa described as new, all flower measurements were made from dried specimens. Throat/lobe ratios were calculated by dividing the throat length by that of the lobe from the point of reflection (not the sinus). Since the number of florets in each head varies considerably, even on the same plant (earlier heads contain more florets than later ones), terminal heads and/or the first one or two successive ones were used for these counts. Obviously late-flowering specimens with abortive flowers and injured plants were excluded. Achene-pubescence was measured to the nearest tenth of a millimeter by use of an ocular micrometer. Measurements were taken

from those hairs at the middle of a corner of the achene. With some exceptions, achenial pubescence proved fairly constant in any one taxon.

Since leaf segmentation has frequently been useful in drawing varietal lines, especially in the *H. filifolius* group, a particular part of the leaf was needed for measurement so as to compare the various taxa uniformly. The terminal segment at the apex of the leaf has therefore been selected for the linear measurements used in the keys (but not in descriptions).

Leaf silhouettes were made in the following manner: Leaves were collected fresh and pressed flat. When dry, these were inserted between sheets of white paper and a soft lead pencil used to shade the top sheet so as to reveal the exact outline of the leaf below. This outline was then filled in with India ink and the pencil smudge erased.

## Specific Concepts

In the present paper the natural units of *Hymenopappus* have been delimited by the combined information obtained from morphology, cytology, ecology, and geographic distribution. An attempt has been made to treat the taxa consistently with respect to their designation as species, variety, or population. In some instances distinct populations have been pointed out as perhaps worthy of varietal rank, but because of the complexities involved, and the further studies needed to delimit these groups properly, nomenclatural status has not been assigned.

The use of the term "variety" for infraspecific units follows the usage implied by the International Code of Botanical Nomenclature (1952, Article 14 and Appendix 3, Article C.5). The author believes this is desirable since the term has become ingrained in botanical usage and classification. In addition, the use of "subspecies" for the taxa here designated as varieties would not leave available a recognized term for the grouping of these infraspecific taxa, a course which has not been followed in this study but which may become advisable with accumulation of more information.

## Generic Relationships and Taxonomic Position

The species of *Hymenopappus*, as here delimited, make up a

closely knit, natural group whose members are more similar to each other than to any known member of another genus. The total similarity of corollas, achenes, leaf patterns, and general aspect in the included taxa is truly remarkable, especially when one considers that the genus includes everything from perennial plants with chaffy receptacles and rayed heads to biennials with neither chaff nor rays.

Some workers (Hoffman, 1897; Rydberg, 1914; Johnston, 1923) have included various species of the genus *Hymenothrix* in *Hymenopappus*, mostly on the basis of pappus morphology, or other achenial characters. *Hymenothrix* was proposed by Gray (1849) to accommodate *H. wislizenii*, an annual species of southern Arizona, New Mexico, and adjacent Mexico. Subsequently four other species from the same general area were added to the genus by various authors. Heretofore, the chief character used to distinguish the two genera was the excurrent awn or midrib on the pappus scales of *Hymenothrix* as opposed to the included midrib on those of *Hymenopappus*. However, it was found that *Hymenothrix palmeri* may or may not have awns extending from its pappus scales and, consequently, it was thought that this situation destroyed the distinctions between the genera. Accordingly, Rydberg (1914) distributed the species of *Hymenothrix* in three genera: He recognized *Hymenothrix* as monotypic; established a new genus *Trichymenia* for one of the species (*H. wrightii*); and put the remaining species in *Hymenopappus*. Johnston (1923) accepted Rydberg's treatment stating, "I am following the only natural alternative of recognizing *Hymenothrix* and *Trichymenia*. The generic lines as here taken are very weak and those that maintain them must find their arguments in precedence and convenience."

There are several morphological characters which distinguish *Hymenopappus* from *Hymenothrix* (including *Trichymenia*), and so far as is known, the two genera are separated by discontinuities which are not bridged. Chromosomal studies should offer additional evidence bearing on this problem, but it is felt that the morphologic differences alone are sufficient to distinguish the two as genera, and it is doubted that they are even closely related. Inasmuch as it destroys the coherence of both groups, Rydberg's treatment is highly artificial. The

important distinctions between these genera are enumerated below:

| Hymenopappus | Hymenothrix |
|---|---|
| 1. Disk corollas regular, the lobes all alike. | 1. Disk corollas zygomorphic, the lobes unequal (inconspicuously so in *H. wislizenii*). |
| 2. Leaves bipinnately compound to simple. | 2. Leaves biternately or triternately compound. |
| 3. Plants biennial or perennial. | 3. Plants annual (?). |
| 4. Corolla lobes (after anthesis) strongly recurved. | 4. Corolla lobes erect or merely spreading, not recurved. |
| 5. Pappus scales with medial nerve completely included. | 5. Pappus scales with medial nerve extending to the apex or excurrent into a distinct awn. |

The author has made no attempt to separate *Hymenothrix* from *Florestina* or other related genera; that is a problem for the future, but the exclusion from *Hymenopappus* of all species of *Hymenothrix*, and the retention of these species together in the same genus (including *Trichymenia*) seems sound on the evidence available at present.

*Hymenopappus* apparently has no immediate relatives within the Helenieae. The majority of the species of the genus are clearly derived from an ancestor with rays and chaff, perhaps not too unlike *H. newberryi*. Since such a species would not key to or fall naturally within the circumscription of the Heleneieae, it would seem logical to look to other tribes for its relatives. In this connection, it is interesting to note that Hoffman (1897) in Engler and Prantl's world treatment of Compositae included *H. newberryi*, as the genus *Leucampyx*, in the tribe, Anthemideae, as did Gray (1877). Bentham and Hooker (1873)[6] also placed *Leucampyx* in the Anthemideae stating, "Genus evidenter *Anthemidi* quam maxime affine, different patria, receptaculo ut videtur parum convexo, achaeniorum magnitudine et forma, et styli ramis minus truncatis."

Thus it seems likely that *Hymenopappus* as a genus has its closest relationship with members of the tribe Anthemideae or perhaps some as yet uninvestigated member of the tribe Heliantheae (many of the characters of *H. newberryi* might place its ancestors here). This does not mean that the tribe

[6] *Leucampyx* was first published and credited to Gray by these authors, but no specific name was proposed.

Helenieae in general is not a natural group, but rather that *Hymenopappus* appears to be not as closely related to members of the Helenieae as to members of the tribes mentioned above.

## Distribution, Ecology, and Possible Origin

*Hymenopappus* occupies an extensive area in the western and southwestern United States and central Mexico. The genus can be divided into two well marked geographical and morphological groups: Series Perennes, the principal members of which occupy the mountainous areas of the western United States and central Mexico, and Series Biennes, the principal members of which occupy the plains and lower areas to the east and southeast of the Rocky Mountains.

The species of Series Perennes appear to show, for the most part, a progressive adaptational trend toward xerophytism. The more primitive members of this series (see discussion below), *H. newberryi* and *H. radiatus*, have restricted distributions, and occupy more mesic situations (*Pinus ponderosa* to *Picea engelmannii* zones) than do the obviously more advanced taxa of the *H. filifolius* complex, the members of which occupy more xeric habitat types (*Pinus ponderosa* zone and lower).

Species of Series Biennes may, in turn, be grouped into two main morphological and geographical types: (1) a group of taxa having bipinnately dissected basal rosette leaves and corollas with campanulate throats, these taxa ranging from the central Great Plains to western Texas and Mexico along the eastern periphery of the range of Series Perennes; (2) a group of taxa having less dissected basal rosette leaves and corollas with funnelform throats, ranging along the Gulf Coastal Plain to Florida, and northward up the Mississippi Valley to Kansas, Illinois, and Indiana.

As in Series Perennes, the most primitive member of this group, *H. biennis*, is a rayed species. It occurs in the higher mountains of southern New Mexico and adjacent Trans-Pecos Texas, and commonly is associated with *Pinus ponderosa*, *Pseudotsuga taxifolia*, or *Picea engelmannii*. *H. biennis* seems to represent a surviving species or close relative of the ancestral stock which gave rise to the Biennes. The campanulate-throated members seem not to have migrated far from their

ancestral source, but have become adapted to more xeric conditions, developing (or retaining) bipinnately dissected leaves. The funnelform-throated groups appear to have branched off early enough from this ancestral biennial stock to retain less dissected, often simple leaves, perhaps indicating rapid spread and adaptation to more mesic situations to the southeast of the present-day Rocky Mountains.

Combining geographical, ecological, and morphological evidence with the apparent evolutionary trends of the major groups it is possible to suggest a plausible history of the genus as concerns speciation, migration, and present day distribution.

In order to understand the evolutionary trends in the genus it is necessary to reconstruct the appearance of the probable ancestral stock. This has been done by pooling all the assumed primitive characters now found in the various taxa. Such a procedure is justifiable on the assumption that the group is monophyletic and that the species existing today have retained some primitive characters while losing or modifying others. The critical part of this reconstruction is distinguishing between those characters which are primitive for the genus, and those that are derived. The following is a list of what the author considers primitive and corresponding derived characters of the genus *Hymenopappus*.

| *Primitive* | *Derived* |
|---|---|
| 1. Receptacle chaffy | 1. Receptacle non-chaffy |
| 2. Ray flowers present | 2. Ray flowers absent |
| 3. Root perennial | 3. Root biennial |
| 4. Leaves simple | 4. Leaves dissected |
| 5. Stem leafy | 5. Stem subscapose |
| 6. Inflorescence few-headed | 6. Inflorescence many-headed |
| 7. Achenes pubescent | 7. Achenes glabrate |
| 8. Involucral bracts mostly non-membranous | 8. Involucral bracts mostly membranous |
| 9. Pappus scales well developed | 9. Pappus scales much reduced or absent |
| 10. Receptacle large, convex | 10. Receptacle small, nearly flat |
| 11. Self-fertile | 11. Self-sterile |

From this tabulation, the reconstructed ancestral species of *Hymenopappus* should be, in general, a leafy-stemmed perennial with simple leaves, having a few-headed inflorescence, ray florets, and chaffy receptacle (see diagrammatic scheme of

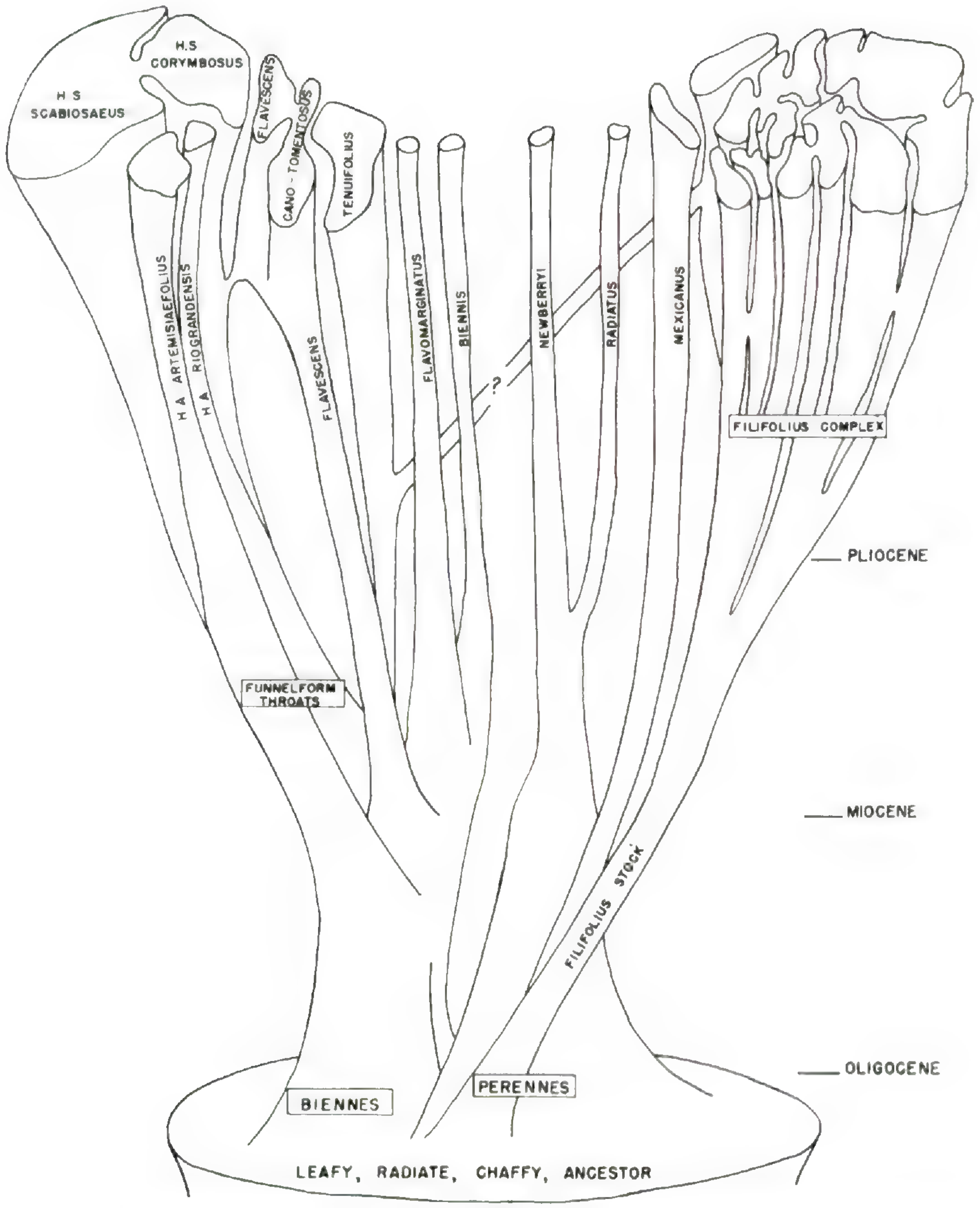


Fig. 22. Schematic representation of the suggested origin and evolution of present-day *Hymenopappus* species.

phylogeny, Fig. 22). No single species of present day *Hymenopappus* has all the primitive characters listed above, but *H. newberryi* retains seven of them (1, 2, 3, 6, 8, 10, 11), and is probably the least advanced or most primitive member of the genus.

The two most primitive members of the Perennes, *H. newberryi* and *H. radiatus*, and the most primitive member of the

Biennes, *H. biennis*, are restricted in their ranges, occupying the forested mountains of southern Colorado, east-central Arizona, and southern New Mexico (Fig. 24). These species (and those derived from them) seem not to have their immediate affinities with the present-day Composite genera of western North America; indeed, if past students of the Compositae were correct in assigning *H. newberryi* to the tribe Anthemideae, its nearest relatives should be in Eurasia, where most present-day members of the Anthemideae are concentrated (Bentham, 1873). Whether this is true or not, it seems likely that these species have come from the north via the Rocky Mountains. This is attested by the following facts:

(1) The most primitive members of the genus are associated with a number of temperate mesophytic species, perhaps representing relic members of the once more widespread Arcto-tertiary Flora.

(2) Clearly more reduced species have apparently diverged from a southern Rocky Mountain center westward, southward, and southeastward (it would be most difficult to read this speciation in a reverse direction, as this would call for progressive development of rays and chaff—characters which nearly all workers in the Compositae agree are primitive).

(3) Lack of closely related genera to the south (absence of such groups to the north can possibly be explained by the destruction of related genera, if such existed, by progressive climatic change since Oligocene time and the Pleistocene ice advances).

Thus it seems possible that the ancestral stock of present day *Hymenopappus* migrated southward down the uplifting Rocky Mountain chain in Oligocene time, possibly along with other members of the Arcto-tertiary Flora (Chaney, 1947). The Miocene epoch saw the break up of this ancestral stock into several well-developed lines. Biennial taxa developed and spread southward to central Mexico and eastward to southern Texas. The funnelform-throated species seem to represent the terminal members of this imagined expansion, and appear to have developed in Pliocene time, and spread secondarily from southern Texas, occupying the Gulf Coastal Plain and inland habitats of the upper Mississippi Valley (evidenced by

the considerable variability and presence of assumed primitive members in southern Texas; cf. *H. artemisiaefolius* var. *riograndensis*).

The campanulate-throated biennial species, as already noted, remained mostly peripheral to their supposed ancestral center, and have retained many of the characteristics of *H. biennis*. Specifically, it seems likely that *H. tenuifolius* became adapted to the arid plains east of the Rocky Mountains, possibly in Pliocene time, and has since remained associated with the grasslands of this region; while *H. flavescens* var. *cano-tomentosus* became adapted to the more southern intermontane xeric habitats of Arizona, New Mexico, and Trans-Pecos Texas.

*Hymenopappus filifolius* of the Perennes series is the most complex and widespread species of the genus. It is likely that its range, infraspecific variation, and complexity is a reflection of the climatic vicissitudes and geologic events of the region in which it is now located.

Pliocene time saw the development of extremely arid conditions in the Great Basin area west of the Rocky Mountains (Axelrod, 1948). Thus, one might visualize the spread of some ancestral *Hymenopappus filifolius* stock from a more mesic habitat type of southern Colorado and northern New Mexico to this newly formed desert basin. With the stimulus of aridity, rapid evolution may have occurred, as suggested by Stebbins (1952). It seems likely that once a trend toward xerophytism had become established, rapid evolution and diversification might occur, especially if the area occupied is one of much climatic change and geologic unrest. The situation in the present-day *H. filifolius* with its numerous, complex and intergrading infraspecific taxa was perhaps what Axelrod (1948; pp. 134, 135) had in mind when he made the following statement concerning Great Basin environments:

> Furthermore, under the impact of fluctuating Pleistocene climates these environments were in a state of continual flux. In such areas a wealth of new entities may have arisen in latest Cenozoic time, further differentiating from their mid-Pliocene ancestors. Many new forms may thus have evolved in latest Cenozoic time due to the selective influence of rapidly developing and fluctuating localized environments which became successively more narrowly limited in extent. This apparently accounts for the wide ecological diversification of these herbaceous types which show a high degree of adaptation in the utilization of geologically recent, highly localized habitats. Differentiation of the various cate-

gories has been limited largely by the genetic variability of the populations and by the diversity of localized environments. Nonetheless, the relatively short time that these highly-localized environments have been in existence may well account for the low degree of differentiation of many of the categories, and for the rapid evolution that is continuing today.

It seems likely that *H. filifolius* owes much of its infraspecific variation to such a history, along with that variation superimposed by subsequent hybridization and introgression.

There remains to be considered *Hymenopappus mexicanus* of the Perennes series. It apparently represents an early offshoot of the same reduced line. This species does not seem to have given rise to any other present-day taxon, though considerable variability is found in the many populations composing it.

In review, the author suggests the following history of the genus *Hymenopappus* based on the evolutionary trends as gleaned from the evidence offered by present-day morphology, ecology, and distribution (cf. Figs. 22, 23).

(1) Migration of an ancestral stock southward down the rising Rocky Mountains in the Oligocene Epoch.

(2) Separation of this stock in Miocene time into two main evolutionary lines, Biennes and Perennes.

(3) Rapid spread of reduced biennial species southeastward from the Rocky Mountains in Pliocene time with adaptation of the more distant members to coastal, somewhat mesic, habitats; populations closer to the parental source of the Biennes became adapted to relatively xeric grassland habitats.

(4) Ancestral reduced stock of *H. filifolius* became adapted to the newly formed desert basin west of the Rocky Mountains in Pliocene time, and, as a result of aridity, climatic, and geologic disturbance in Pleistocene time, the species produced many variable and intergrading infraspecific taxa which became widely distributed over the Rocky Mountains, Great Basin, and peripheral areas.

(5) Funnelform-throated biennial species have dispersed secondarily from southern Texas to the north and northeast in Pleistocene time.

(6) Present-day ranges show the confinement of primitive species to relatively high, more mesic habitats of the southern Rocky Mountains; advanced reduced species are widespread and occupy more xeric habitat types, except where secondary adaptation and speciation has occurred.

In addition to the broad outline given above, more specific information concerning ranges, ecology and, in some instances, possible origin has been given in the discussion for each of the various taxa concerned.

## Acknowledgements

The author is especially indebted to Professor Marion Ownbey

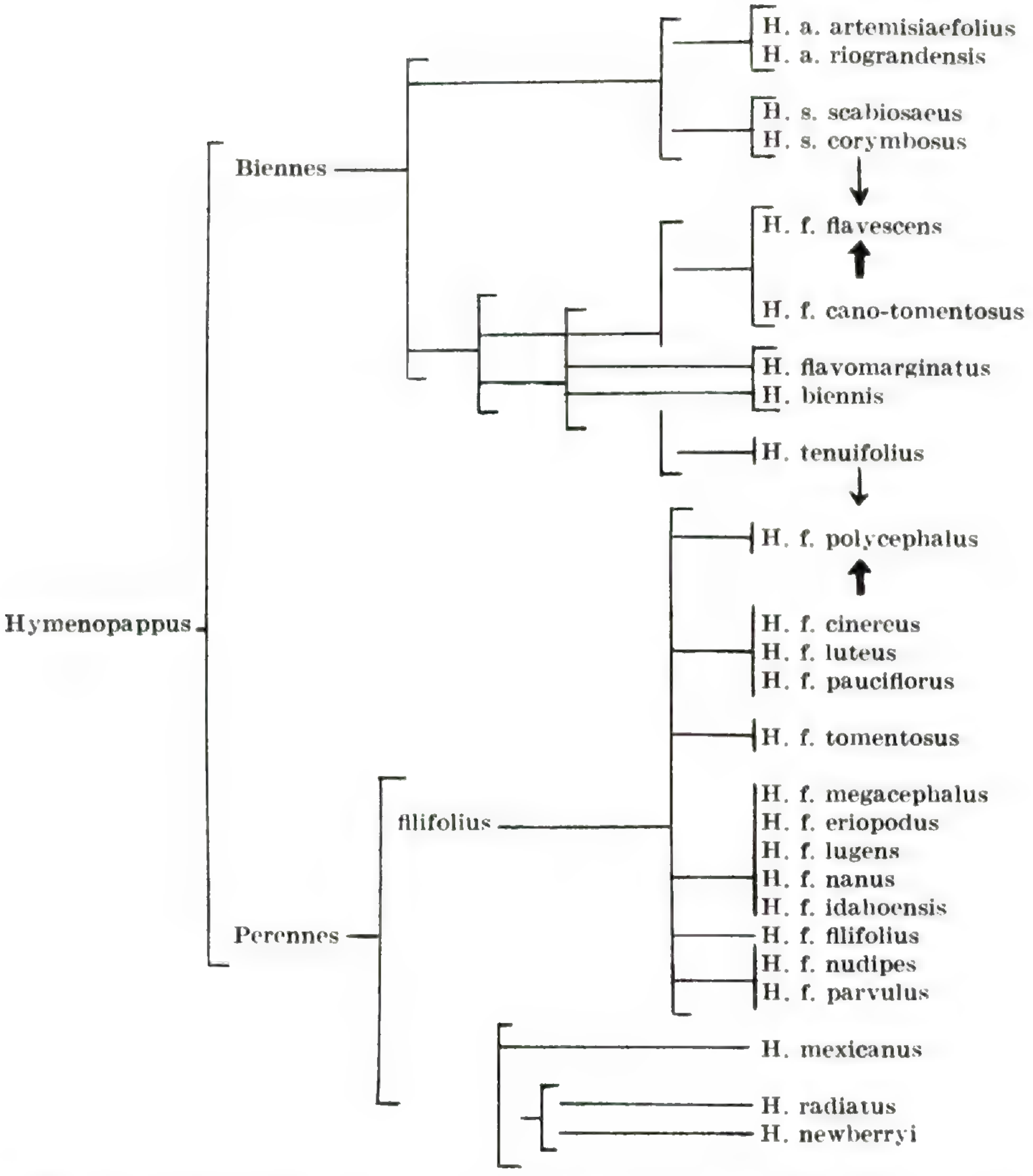


**Fig. 23.** Hypothetical relationships in *Hymenopappus*. Arrows point to taxa of possibly hybrid origin; tail of arrow refers to putative parents; width of shaft indicates the relative amount of characters contributed.

who suggested the problem and under whose direction the work was carried out. Grateful acknowledgement is also made to Rev. S. V. Fraser, Dr. Q. Jones, and Professor B. H. Warnock for seed collections; to Miss Nell C. Horner, Librarian of the Missouri Botanical Garden, and Professor L. H. Shinners for bibliographic information; and to Professor A. Cronquist for obtaining a photocopy of the original publication of *Hymenopappus scabiosaeus* and for his general interest in the problem.

(*To be continued*)

# NEVIUSIA ALABAMENSIS IN ARKANSAS

Dwight Munson Moore

In late April, 1955, the writer's attention was called to some strange shrubs growing on a low sandstone ridge about six air-miles northwest of Conway, Arkansas, in the southeastern corner of Conway County, next adjacent to Faulkner County in which Conway lies. These were growing in some quantity along the sandstone ridge, extending some two hundred yards. Specimens of the plant were collected and, although past their blooming period, were easily identified as *Neviusia alabamensis* Gray. Search in the University of Arkansas Herbarium revealed four other sheets collected in 1925 by D. Demaree along the cliffs of Cove Creek, in the northern part of Faulkner County, and identified then as *Physocarpus*. These also proved to be *Neviusia alabamensis* Gray.

For nearly one hundred years, *Neviusia alabamensis*, a monotypic species of Rosaceae, has been generally considered a very definite endemic in the state of Alabama. It had been found in 1857 by Drs. R. D. Nevius and W. S. Wyman along the cliffs of Black Warrior River a few miles from Tuscaloosa, Alabama. It was sent to Dr. Asa Gray who described it (1858) as a new genus and species, naming it for one of the discoverers, Dr. Nevius. Within the next fifty years other stations for this same shrub were found in three other counties of northern Alabama, but it was still considered a very limited endemic for that state. It has thus been referred to by Chapman (1884), Mohr (1901), Harper (1906), Small (1913, 1933), Rydberg (1918), and Bailey (1935).

In 1918, Dr. J. C. Th. Uphof, while making an extended ecological study in southern Missouri, found a single specimen of this shrub about eight miles west of Poplar Bluff, Missouri. He reported this in 1921 in a German publication, and in 1922, while writing up the ecology of southeastern Missouri, mentioned finding this plant. Unfortunately, his specimens were destroyed before he got them back to U. S. herbaria from Holland, and little attention was paid to his find. As Dr. Uphof said, it was apparently an adventive, probably having been started from seed dropped by birds from Alabama or some

Neviusia alabamensis Gray.

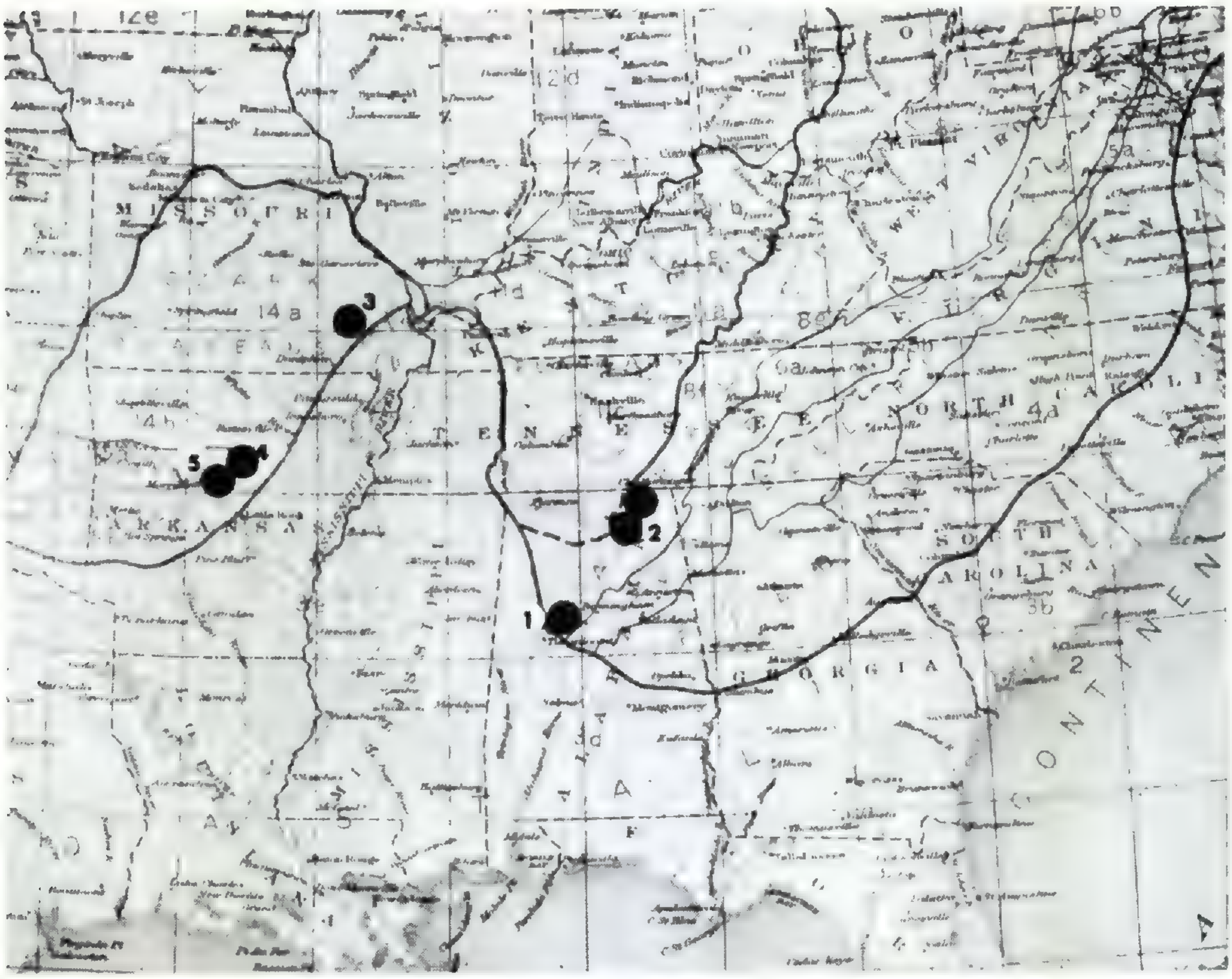


FIG. 1. Map of southeastern United States showing location of collections of *Neviusia alabamensis* Gray at 1. Tuscaloosa (1857) (type locality); 2. other northern Alabama counties; 3. Poplar Bluff, Mo. (1918) 4. Cove Creek, Ark. (1925); Conway Co., Ark. (1955). Continuous line indicates margin of Coastal Plain.

hitherto unknown location in Tennessee. However, Harper (1928), in his *Catalogue of the Trees, Shrubs, and Vines of Alabama*, acknowledged the new discovery and mentioned it as the only place outside of Alabama where this plant had been found growing wild. In 1931 Fernald called attention to the relationship of this unique plant to its nearest relative, *Kerria*, in eastern Asia, and Bailey (1935) refers to it as very limited in Alabama. Palmer and Steyermark (1935) apparently did not consider the report of this one specimen sufficient for including it in their *Catalogue of the Flowering Plants of Missouri*, or they doubted Uphof's identification. Comparison of Uphof's drawing, here reproduced, with Gray's original drawing (1858) seems to leave no doubt as to his accuracy. Even as late as 1944, Cain refers to *Neviusia* as an example of extreme local endemism, showing it on a map as located only at Tuscaloosa.

With two Arkansas stations for this unusual plant, it seemed

logical to pursue further the reported find in southeastern Missouri. Search in July, 1955, in the region indicated west of Poplar Bluff, failed to reveal any evidence of the plant. However, this is not surprising, when consideration is given to all the changes of roads, fields, and other marks of 'civilization.' Furthermore, it may still be possible to find this or more plants of the same kind if it is sought in the spring when it would be in flower.

This now seems to make a very definite picture. By placing these locations on a map (fig. 1) showing the Mississippi embayment of the old Gulf Coastal Plain, it may be seen that the original find lay on the eastern side of the embayment, while the one from Missouri and the two from Arkansas are on the northwestern side of this embayment. In Alabama they are reported on sandstone, shale, and limestone. In Missouri it was reported on sandy loam, while in Arkansas the finds were both on sandstone outcrops. In all cases they appear to be on carboniferous or subcarboniferous formations. Geological evidence points to the fact that this particular area has been exposed above the encroachments of the sea since the late Paleozoic or early Mesozoic. This might lead us to believe that *Neviusia alabamensis* would be classified as an epibiotic, a relatively old relic species, according to Cain (1944), rather than a strict endemic which he would consider to be a relatively youthful species. At least, *Neviusia alabamensis* may no longer be considered to be strictly an Alabama endemic, but like a few other species it must be shared with other similarly located states.

Credit should be given to Mr. Marvin Lawson of Conway who had seen these plants there and recognized them as something unusual and who called them to the attention of the writer. Thanks are also extended to Dr. Hugh Iltis for his encouragement in the pursuit of this unusual find, and to Drs. Uphof and Harper who have aided in the location of some old records which have helped materially in getting this more nearly complete picture of *Neviusia alabamensis*. At Poplar Bluff, Mo., Mr. Frank Hearne was very coöperative in the attempt to relocate Uphof's station.—UNIVERSITY OF ARKANSAS, FAYETTEVILLE, ARKANSAS.

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HUMBOLDT AND AMERICAN BOTANY.[1]—"Alexander, that is a beautiful name. I seem to recall an earth-conqueror by that name. Do you wish to be a conqueror?" "Yes, Sire,—but with my head." So replied Alexander von Humboldt, aged eight, to King Frederick the Great. At the end of a long life there arrived in Berlin in 1857 an American, Bayard Taylor. He remarked, "I came to Berlin not to visit its museums, and galleries, its operas, its theatres, not to mingle in the gay life—but for the sake of seeing and speaking with the world's greatest living man—Alexander von Humboldt."

For Humboldt had seen both Bogotá and Baltimore, had conversed with Indian tribes and that student of Indian vo-

[1] HUMBOLDT. THE LIFE AND TIMES OF ALEXANDER VON HUMBOLDT, 1769–1859. Helmut de Terra. Alfred A. Knopf, N. Y. i-xvi, 1-386, i-ix. 8 plates, 3 maps. 1955.

cabularies, Thomas Jefferson, had climbed many of the highest peaks in tropical America and studied their faunas and floras. The historian George Bancroft wrote, "Humboldt was always the friend of young America."

The latest biography of "the greatest scientific traveller who ever lived," as Charles Darwin characterized Humboldt, has just been written by the geographer, Dr. Helmut de Terra, and beautifully produced by Alfred A. Knopf. The author has turned over materials that have long slept in Marburg and Paris, as well as the familiar sources in this country, but it is rather of some adjacent pastures still fallow that I should like to direct attention.

In 1804 at the age of thirty-five Humboldt paused in this country for eight weeks en route from Cuba to Paris, that is, at the conclusion of his great hegira to tropical America. In Philadelphia Humboldt particularly visited Prof. Benjamin Smith Barton, Benjamin Rush, and Charles Willson Peale. Peale's Philadelphia Museum, the largest of its kind in the New World, tremendously interested the young Humboldt.[2] He spent three weeks at Jefferson's Monticello, talking, walking, going over many matters of mutual concern. He spoke to Jefferson of having Congress purchase the museum amassed by Peale and thus establish a national collection. It was late May when the party of six, conducted by Peale, set out for Baltimore and Washington by coach. The other four were Aimé Bonpland—familiar to botanists for the abbreviation "H. B. K." which trilogy records the part played by the nephew of Humboldt's former tutor, Karl Sigismund Kunth, who did not accompany Humboldt and Bonpland—, Don Carlos Montufar of Quito, Dr. Anthony Fothergill,[3] and the Rev. Dr. Nicholas Collin.[4] The pilgrimage was not without its speechless moments. Peale's "dental bridge having broken, he rushed out to look

[2] For the tragic fate of Peale's historic specimens, another 'short chapter in the history of human stupidity,' see Thomas Barbour, A Naturalist's Scrapbook, 91–97. 1946.

[3] Anthony Fothergill (1733–1813), M. D., nephew of John Fothergill, came to America about 1803. Cf. R. Hingston Fox, Dr. John Fothergill and His Friends, 131–132. 1919.

[4] Nicholas (or Nils) Collin (1746–1831), student at Upsala, who arrived at Penns Neck, N. J. in 1778 and became rector of Swedish Churches in Pennsylvania. Aside from collecting seeds and plants and sending them to his native Sweden, he was interested in lead-glazing, philology, colonial history, climatology, etc. Cf. Th. Krok, Biblio. Bot. Suecana, 131, 1925; G. G. Simpson, Amer. Philos. Soc. **86**: 130. 1942, and W. J. Bell Jr., Early American Science, 4, 15, 1955.

for a gunsmith to borrow tools to repair it. For one who had mounted the skeleton of a mammoth, this was a fast and easy job. Luckily he carried a few pieces of gold in his pocket, and so managed to mend his artificial teeth in time to rejoin the company for the rest of the evening."

Dinner at the Executive Mansion, visits with the first architect of the new capitol in Washington, Dr. William Thornton,[5] a conference with Secretary of the Treasury, Albert Gallatin, and a boat trip down the Potomac to Mt. Vernon (where now only Washington's negro body servant lived to tell his master's story first-hand), filled his days and evenings. Of Bonpland, then twenty-nine years of age, we should particularly like to know more, but he was eclipsed by Humboldt's overwhelming importance and handicapped by his inability to converse in English. The two visitors called on Henry Muhlenberg at Lancaster and the "American Linnaeus" packaged 160 grass specimens for Humboldt to compare with Michaux's collections at Paris. Humboldt's letter, not mentioned by de Terra, is of special interest to the botanist, it reads:

My dear and honored friend,

I use these last moments before my departure tomorrow, to express once more my heartfelt thanks to you for the great kindness which you showed me and my friends in Lancaster. Your grasses and your kind letter have come to hand and I promise to let you know Michaux's names for them. Bonpland commends himself to you with gratitude for your kind remembrance. Yesterday he had a delightful noon with your brother the worthy General. Remember me to the good Ellicott[6] and Mr. William Barton.[7] We saw the Hamilton garden with astonished delight.

Yours
most gratefully
Humboldt[8]

Philadelphia
the 27th June 1804

[5] William Thornton (1761–1828), M. D., a close friend of Jefferson, who evidently owned a set of plant drawings. He was a founder and one-time curator of the Columbian Institute for the Promotion of Arts and Sciences. Cf. E. M. Betts, THOMAS JEFFERSON'S GARDEN BOOK, 1766–1824, 398 *et passim*, 1944.

[6] Andrew Ellicott (1754–1820), civil engineer, who while laying out state boundaries collected plants unfamiliar to him. A few of these are preserved in the B. S. Barton Herbarium (ANSP). Cf. W. J. Bell Jr., *op. cit.*, 55–56.

[7] William P. C. Barton (1786–1856), who succeeded his uncle, B. S. Barton, as professor at the University of Pennsylvania. Cf. F. W. Pennell, BARTONIA no. 21: 45. 1940.

[8] Paul A. W. Wallace, MUHLENBERGS OF PENNSYLVANIA, 313. 1950.

Thus we have one more distinguished visitor to the "Woodlands"! Naturally it is of particular interest to this reviewer to note that Frederick Pursh was head gardener at Hamilton's estate at the time of Humboldt's visit. When is some member of the Philadelphia Botanical Club reconstructing William Hamilton's guest book? From the good beginnings made by Sarah P. Stetson[9] and others this is now a practicable project.

Audubon's friend and associate, Rev. John Bachman of Charleston, was present at the dinner given in honor of Humboldt at Peale's Museum. Bachman was barely fifteen at the time and was probably invited through the influence of Alexder Wilson.

> the two Bartrams, Wilson, the ornithologist, Lawson, his engraver, George Ord and a few others . . . Few speeches were made and those were short—there was no formality . . . Humboldt was then, as he was afterwards, in every society, "the observed of all observers" . . . [Bachman] saw him every day during the few days he remained in Philadelphia. He inserted my name in his note-book, and for the last sixty years we corresponded at long intervals.[10]

But when Humboldt finally sailed in July aboard the frigate *Favorita* down the Delaware for Bordeaux it was of Jefferson and those delightful weeks at Monticello that he recalled with special pleasure. It is not easy thoroughly to assay the influence of Humboldt's visit on Jefferson's great plan for the exploration of the West, so well advanced by the nearly completed expedition of Lewis and Clark, but it is certain that Humboldt's bold approval of Jefferson's aims gave encouragement to what was not a wholly popular program at the time.

Soon Humboldt's familiar pictorial diagram of Chimborazo demonstrating the zonation of vegetation "corresponding with its progress in different latitudes" was used as the frontispiece of a botany text published in 1829 by the vice-principal of Troy Female Seminary, Mrs. Almira H. Lincoln. Her *Familiar Lectures in Botany* enjoyed a sale of more than 275,000 copies in the succeeding forty years in the higher schools and academies of this country.

[9] Penna. Mag. Hist. Biog. **73**: 26–33. 1949. Cf. also Thompson Westcott, Historic Mansions and Buildings of Philadelphia, 415 *et seq.* 1877; John T. Faris, Old Gardens in and About Philadelphia, 150 *et seq.*, 1932, but use with caution; J. Ewan, Proc. Amer. Philos. Soc. **96**: 603–605. 1952.

[10] F. H. Herrick, Audubon the Naturalist, **2**: 284–285. 1917.

Humboldt's American contacts continued throughout his lifetime. When Balduin Möllhausen, topographer and artist to Whipple's Pacific railway survey, visited Berlin with a consignment of animals for the city's zoo and paid a call on Humboldt, he met the daughter of Humboldt's valet. Later as Möllhausen crossed New Mexico with Whipple's party he wrote long love letters to Alexandra Caroline Seifert. It is generally recorded that Dr. John M. Bigelow was the botanical collector on Whipple's survey, but we find Möllhausen, in de Terra's words, "laden with plant and rock specimens for Humboldt to study." This Möllhausen material, which may represent authentic duplicates of species described from Bigelow's collections, may yet come to light, The diary of Dr. C. B. R. Kennerly, physician and zoologist to the survey, preserved in the Division of Manuscripts, Library of Congress, may hold the answer to this riddle. This is the Möllhausen called the 'German Cooper' for his immensely popular Indian love stories, travel lore, poetry, and some eighty novelettes![11]

Fremont spread Humboldt's fame in this country. Using extensively and taking inspiration from Humboldt's writings, Fremont was warmed by the praise accorded his Report. Alas! the argonauts who drank the bitter waters of the 'Humboldt Sink' in the rush for gold had little praise for either Fremont or the man he honored. Latin America preserves many witnesses of its appreciation for Humboldt. Bolivar and Humboldt stand side by side not only as twin peaks in the high range above the beautiful city of Merida but in the hearts of her patriots. Bolivar, to whom Humboldt gave encouragement, said that the "learning" of his friend had "done America more good than all the conquerors." Mutis, pupil of Linnaeus, and Humboldt and Bonpland worked in adjoining houses in Bogotá, and Mutis's biographer, A. Federico Gredilla, quotes long letters that passed between them.[12] We are still in desperate need of a biography in English of this great figure, whose library and collections of plant drawings were said to be second only to those of Joseph Banks. Sir Robert Schomburgk's explorations

[11] Möllhausen's contacts with John Xantus are interesting in this connection. Cf. H. M. Madden's Xantus: Hungarian Naturalist in the Pioneer West, 72, 238, 1949.

[12] Supplementary to Sprague's paper of 1926, cited by de Terra, cf. A. Dugand, Rev. Acad. Colomb. 9 (35): 210–213. 1954.

in Guiana keenly interested Humboldt, and he was again delighted when Prince Adalbert of Prussia's *Travels* in Brazil were translated by Schomburgk. In a preface Humboldt prepared for the English edition, he remarked, "if human civilization, which is making such giant strides in North America, should ever penetrate into these fastnesses (a hope which St. Basil calls 'day-dreams of man'), the structure of this great net of rivers, from north to south, may open channels of communication such as are unknown in any other part of the world."

Humboldt was a prodigious worker: in his early sixties he was working simultaneously on the final volume of his *histoire de la geographie* of America, completing his Asiatic studies—he had travelled 9600 miles through Asiatic Russia by coach in twenty-five weeks—and was planning the first volume of his great synthesis—now seldom read—entitled *Cosmos*. His writings exceeded in bulk those of any contemporary naturalist, rivalling Buffon and Leibnitz. His later writings were ponderous and at times repetitious; Arago, the physicist, had, in fact, insisted that Humboldt really did not know how to write a book, but that he wrote endlessly, and the result was not a book "but a portrait without a frame." The Scot, William Macgillivray, composed a useful resume of his travels and researches which went into a second edition. Corresponding and writing, the "Prometheus of our time" worked on, meeting American visitors, as when Prof. Benjamin Silliman of Yale visited him in 1851, and parrying with some over-zealous investigators: in 1843 a Dresden anatomist requisitioned Humboldt's skull upon hearing of his illness! Of that skull-duggery I know no more.

"I used to admire Humboldt, now I almost worship him," wrote Charles Darwin to his teacher Professor Henslow. Darwin insisted that his entire career was a consequence of his reading Humboldt's *Narrative of Travels*. The botanist Berthold Seemann said that "by his glowing descriptions of tropical scenery" Humboldt "did more than any one living to encourage that desire for the exploration of equinoctial regions, to which we owe . . . directly the elaborate works of Martius, Griffith, Blume, and other botanists of eminence." Humboldt was the fillip of Louis Agassiz's trip to Brazil. Prescott wrote that he was guided "by the light of his researches" and added that he

missed Humboldt's hand in his study of Peru which lay just beyond Humboldt's fields.

Dr. de Terra's biography is a highly successful portrait (with a frame!) done in sepia with plunging strokes. This biography does not intend to be exhaustive as the good index will quickly demonstrate. There is still a genuine need for a full and documented biography along natural history lines, dressed for its immense potential reference value but blind to Brentano's show window. This unborn biography will integrate from the rich *reliquiae* of Humboldt letters around the world, identify their personalia, trace the intercourse across the Atlantic, from amateur to mentor and back again, all arrayed at finger-tip accessibility by a complete index. The botanical collector Benedict Roezl discovered a new lily in California in 1869 and as a centennial gesture it was named for Humboldt. How fitting that Humboldt's second centennial should be marked by an Olympian biography. Shall it be called "Prometheus Unbound"?—Joseph Ewan, tulane university, new orleans, la.

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Asclepias syriaca var. kansana in New York State.—At the time of the 1952 meetings of the Botanical Society of America in Ithaca, New York, one of the local field trips planned for the Ecological Society included a stop northeast of Geneva on the east side of Seneca Lake. In the waste ground bordering the road was an extensive stand of *Asclepias syriaca* L. All gradations were observed from the essentially plain-surfaced fruits of forma *inermis* to the spiny-fruited var. *kansana* (Vail) Palmer & Steyerm. The collection data for the plants referred to var. *kansana* are "open ground bordering ditch along east side of highway 96 A, northeast of Geneva, on east side of Seneca Lake, Seneca Co., New York, September 11, 1952, *Steyermark & Swink 74625*." The range given for this spiny-fruited variety in Gray's Manual, eighth edition, is "Ia., Neb., Mo. and Kans." While Woodson in his recent monograph of the genus (Ann. Mo. Bot. Gard. **41:** 105–108. 1954) does not consider var. *kansana* to merit taxonomic rank, he does acknowledge the fact that the plants of the western states are *predominantly* spiny-fruited, while those of the eastern states

are *predominantly* smooth-fruited (loc. cit. p. 108, text and footnote). He relegates their status, however, to races and clines. Dr. Woodson's careful monograph notwithstanding and with our highest admiration for this work, the fact still remains that the field worker and local botanist, examining the two extremes of the fruit, one from the west with the spiny processes conspicuous, the other from the east nearly or quite plain-surfaced, are impressed by the *constancy* and *prevalence* of the spines or lack of them, depending upon the geographical location. The student and local botanist in Missouri and Kansas encounters the spiny-fruited type practically all the time, whereas in the eastern states the excessively spiny-fruited type is practically unknown. Since this morphological character can be combined to a certain degree with a circumscribed range, it does not seem to the present authors inappropriate to maintain varietal status for the predominantly western spiny-fruited var. *kansana*. If the spiny-fruited plants were found to be everywhere within the range of the smooth-fruited or less spiny types, there would be no point in maintaining a geographic status for the spiny-fruited plants. One expects to find every kind of intergradation where the boundaries of the one type pass over into those of the other, but that should not mitigate against the recognition of the two varieties, at least from the standpoint of a convenient category or name for purposes of identification. Also from the geographical standpoint, it would appear proper to retain taxonomic recognition of var. *kansana*. In addition to the single station for var. *kansana*, cited above for New York state, a new eastern record, the authors observed the spiny-fruited type in various parts of northern Illinois and Indiana. If the var. *kansana* is maintained, its range should be extended to include the states of Illinois, Indiana, and New York.—Julian A. Steyermark and Floyd A. Swink, chicago natural history museum and college of pharmacy, university of illinois.

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## ON THE IDENTITY OF LESQUERELLA ANGUSTIFOLIA


Reed C. Rollins


Fernald's revision of Gray's Manual,[1] Gleason's revision of Britton and Brown's Illustrated Flora[2] and Palmer and Steyermark's Catalogue of the Plants of Missouri[3] include *Lesquerella angustifolia* on the basis of its presumed occurrence in the state of Missouri. In this, these authors undoubtedly followed Payson who, unfortunately, misapplied the name in his monograph of *Lesquerella*.[4] He applied the name to a species occurring in southwestern Missouri and previously regarded as *L. gracilis*, but which is actually distinct from both *L. gracilis* and *L. angustifolia*. As a result of this confusion, Cory[5] was led to re-describe *L. angustifolia* as a new species under the name *L. longifolia*.

The original description of *L. angustifolia* in Torrey and Gray[6] and that of Watson[7] are definite enough and were obviously based on the original collection of Nuttall and a subsequent collection by Leavenworth, both obtained along the Red River more than a century ago. Evidently, the fact that *L. angustifolia* was not recollected in the interim between these early collections and the time Payson studied the group had something to do with his misinterpretation of the earlier work.

[1] Gray's Man. Bot. (ed. 8) p. 700. 1950.
[2] Ill. Fl. N. E. U. S. adj. Can. **2**: 226. 1952.
[3] Ann. Mo. Bot. Gard. **22**: 547. 1935.
[4] Ann. Mo. Bot. Gard. **8**: 182. 1922.
[5] Field & Lab. **18**: 96. 1950.
[6] Fl. N. Am. **1**: 101. 1838.
[7] Proc. Am. Acad. **23**: 253. 1888.

In order to be sure about the proper application of the name *L. angustifolia*, I have studied the type at the British Museum of Natural History. The type consists of two plants. The lowermost leaves are missing on both plants which are in the ripe fruiting stage. The cauline leaves are linear, thickish, and are covered with minute lepidote trichomes. The pedicels are rigid and divaricately ascending. There are two ovules per locule in the siliques. The type was compared in detail with a specimen of one of my collections (*Rollins 5583*) from the Red River Valley in Choctaw County, Oklahoma. The type and this specimen were found to be closely similar in every respect and unquestionably represent the same species. The type of *L. longifolia* Cory at the Herbarium of Southern Methodist University is also the same, and this name becomes a synonym of *L. angustifolia*.

*L. angustifolia* is not uncommon, usually on thin soil overlaying horizontally bedded limestone, in Choctaw County, Oklahoma. I saw and collected the species in a number of localities and it was frequently in the same location with *L. gracilis*, although the latter species was usually to be found on deeper soils. These two species are somewhat alike in habit, but they can be readily distinguished by the pubescence type and by the ovule number. The trichomes of *L. angustifolia* are disc-like from the fusion of the rays basally and appear as if they were a lepidote covering of peltate scales. At their densest, they make the leaves and stems silvery. The stems and leaves of *L. gracilis* are greener and have a sparser covering of small stellate trichomes with discrete branches. There are two ovules per locule in the ovary of *L. angustifolia*, whereas, in *L. gracilis*, there are from eight to twelve ovules per locule. Evidence of hybridization was not seen where these species were growing together even though I looked for it at several locations.

In addition to the Nuttall type and the Leavenworth collection, both from the Red River, but without any further specific locality data, the following collections of *L. angustifolia* have been studied; **Oklahoma,** CHOCTAW COUNTY: 6 mi. east of Hugo, April 13, 1955, *Rollins 5581* (GH); 6 mi. west of Fort Towson, *Rollins 5583* (GH); 5 mi. west of Fort Towson, *Rollins 5585* (GH); 2–3 mi. west of Fort Towson, May 24, 1953, *Moore & Iltis 405* (GH); 5 mi. east of Hugo, April 15, 1950, *Waterfall 9289* (GH); 9 mi. east of Hugo, *Waterfall 9290* (GH). MCCURTAIN COUNTY: 2 mi.

northwest of Idabel, April 19, 1954, *Waterfall 11820* (GH); near Idabel, May 20, 1916, *Houghton 3680* (GH). **Texas:** 1.5 mi. southeast of Clarksville, Red River County, May 12, 1949, *V. L. Cory 56031* (SMU, type of *L. longifolia*).

From the above data, it would appear that *L. angustifolia* is rather restricted in its range. It may be confined to a limited limestone area in southeastern Oklahoma and adjacent Texas. Such a restricted area of distribution would account, in part at least, for the long gap between the early collections and the recent ones. This species occurs in the same locality as *Leavenworthia aurea* which appears to be equally restricted in its distribution in southeastern Oklahoma and has had a similar history so far as paucity and infrequency of collections are concerned.

The Missouri species of *Lesquerella* mistakenly identified as *L. angustifolia* by Payson is unquestionably a distinct species. The next question is by what name should it be known? I have searched the literature and find no available name. Therefore, the species has to be described as new.

**Lesquerella filiformis** Rollins, sp. nov.

Annual; stems numerous from the base, slender, branched, erect or the outer somewhat decumbent, densely covered with stellate trichomes, 1–2 dm. high, branches often filiform; basal rosette of leaves not formed; basal leaves few, entire, broadly spatulate to orbicular, rounded at apex, abruptly narrowed to a slender petiole, 1–2 cm. long including petiole, 5–8 mm. wide, stellate trichomes on both surfaces numerous but not overlapping; cauline leaves entire, densely pubescent, 1–3 cm. long, 1–6 mm. wide, lower cauline leaves petiolate, often with a broad blade, gradually becoming narrower and sessile upward; inflorescence not crowded; pedicels filiform, divaricately ascending, nearly straight, 7–10 mm. long, densely pubescent; sepals narrowly oblong, densely pubescent, 3–4 mm. long, ca. 1 mm. wide, outer pair slightly saccate; petals light yellow, spatulate, 7–9 mm. long, 2.5–3 mm. wide; filaments slender, dilated at base; anthers ca. 1 mm. long; siliques globose, glabrous both on the exterior and interior, nearly sessile, erect, 2.5–3 mm. in diameter; styles slender, 3–4 mm. long; stigma unexpanded; ovules 2 in each loculus; funiculi attached to thin septum toward base only; seeds brown, somewhat flattened, not margined.

Herba annua; caulibus erectis ramosis tenuibus pubescentibus 1–2 dm. altis; foliis stellato-pubescentibus; foliis radicalibus petiolatis integris late spathulatis vel orbicularibus 1–2 cm. longis, 5–8 mm. latis; foliis caulinis inferne petiolatis superne sessilibus anguste spathulatis vel linearibus 1–3 cm. longis, 1–6 mm. latis; pedicellis filiformibus rectis divaricatis pubescentibus 7–10 mm. longis; sepalis anguste oblongis pubescentibus 3–4 mm.

longis, ca. 1 mm. latis; petalis flavis spathulatis 7–9 mm. longis, 2.5–3 mm. latis; siliquis glabris globosis subsessilibus erectis 2.5–3 mm. diametro; stylis glabris 3–4 mm. longis; loculis 2-ovulatis; seminibus immarginatis.

Type in the Gray Herbarium collected on thin soil, limestone barrens, Turnback, Dade County, Missouri, May 5, 1929, *E. J. Palmer 35604*. An additional collection in the Gray Herbarium is *J. W. Blankenship s. n.* made at Willard, Greene County, Missouri, May 7, 1887.

The illustration and description in Payson's monograph (l.c.), so far as I can interpret them, apply completely to this species. The illustration shows the numerous stems, the branching habit and the lack of a basal rosette of leaves. As pointed out by Payson, the species is amply distinct from *L. gracilis* because of the subsessile siliques with 2-ovuled loculi and the filaments with dilated bases. Actually, *L. filiformis* is more closely related to *L. angustifolia* than it is to *L. gracilis*. However, it has stellae with distinct rays instead of stellae of disc-like peltate scales with basally fused rays as found in *L. angustifolia*. Otherwise, the plants of *L. filiformis* are much smaller in every respect than those of *L. angustifolia*. With respect to height, the upper limit of 2 dm. in *L. filiformis* is about the lower limit for *L. angustifolia*. The lower leaves of the latter are dentate to lyrately pinnatifid, whereas, they are entire in *L. filiformis*. The two species are sufficiently distinctive in aspect to prevent confusion of identity.—GRAY HERBARIUM OF HARVARD UNIVERSITY.

# SOME MICHIGAN RECORDS FOR SARRACENIA PURPUREA FORMA HETEROPHYLLA

Frederick W. Case, Jr.[1]

In 1822, Eaton described a plant from the region of Northampton, Mass. as a supposed new species, *Sarracenia heterophylla*, distinguished by elongate leaves and yellow flowers. Later investigations have shown that the plant is not morphologically different from *S. purpurea* except that it differs in the color of its leaves and flowers. The elongate type of leaf is merely a change caused by shade, similarly shaped leaves being found on shaded plants of the typical form. Consequently, recent authors have reduced the taxonomic status of the plant from species to subspecies, then variety, and finally, a form (Fernald, 1922, 1950, and Gleason, 1952). Bell in his recent cytotaxonomic study of the pitcher-plants (1949) follows the last treatment.[2] The purpose of the present paper is to present new data on the occurrence of this interesting plant in Michigan, the localities reported being a little over 600 miles west of the previously known localities, all of which are along the eastern seaboard. (See map, Fig. 1.)

*Sarracenia purpurea* forma *heterophylla*, as currently understood, is characterized by the complete absence of red coloring anywhere in the plant. The flower petals of living specimens are of a pale lemon-yellow to greenish-yellow color. The leaves, although dull green in shade grown specimens, are yellow-green to rich yellow in sunny situations. In dried material the colors may appear golden- or brown-yellow. If any red coloration is present at all, the plant cannot be regarded as forma *heterophylla*.

Until the presently described locations came to light, all authenticated records for *Sarracenia purpurea* f. *heterophylla* have been confined to the northeast coast of North America, and even here authentic records are extremely rare. Records do exist from the following localities, as reported by Bell (l. c.):

[1] I wish to thank Drs. C. Ritchie Bell, W. H. Wagner, Jr., and E. T. Wherry, for their suggestions. I am especially grateful to Drs. Bell and Wherry for visiting the areas with me on September 4, 1955.

[2] Bell (l.c.) suggests, however, that it is possible that forma *heterophylla* "may deserve higher taxonomic rank."

Northampton, Mass. (where it was collected by Eaton); Main Arm, Bonne Bay, Newfoundland (Fernald and Long); Exploits River and Badger Brook, Newfoundland (Robinson and Schrenk); Young's Lake, Belle Isle, Nova Scotia (Fernald, and also Bell); and Forked River, New Jersey (Britton). Schallert applied the name "heterophylla" to herbarium material from North Carolina, but Bell discounts his records, since most of his specimens show red veining, and therefore should be excluded from this taxon (Bell, 1949). It is likely that all of Schallert's identifications represent deep shade ecads of typical *S. purpurea*.

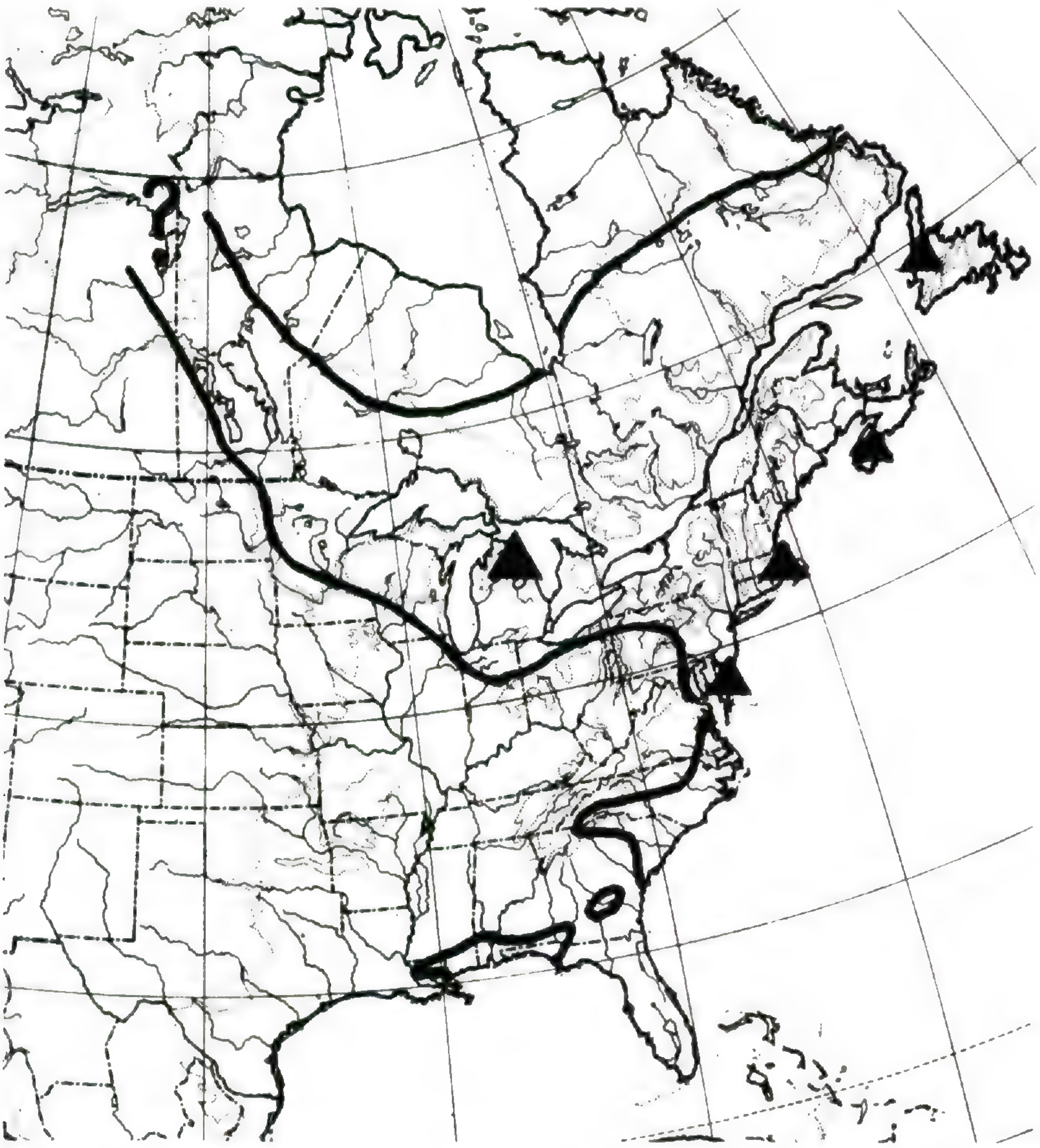

**Figure 1.** The distribution of *Sarracenia purpurea* in North America. The triangles represent authenticated localities for the forma *heterophylla*. General distribution adapted from E. T. Wherry, 1935.

In June, 1948, while botanizing in Montmorency County, Michigan, I came upon yellow-flowered plants of *Sarracenia purpurea* in a large spruce-tamarack bog, but at that time no record of the extent of distribution or of the number of yellow plants was made. Subsequent exploration revealed that forma *heterophylla* occurred in a number of bogs in this vicinity. When it became apparent that the numbers and distribution of the form in this area might possibly show some evolutionary pattern, a more extensive study was initiated. All of the bogs that the author could locate and to which he could gain access were explored during the years 1954 and 1955. This is not to imply, of course, that all suitable habitats in this bog-rich area have

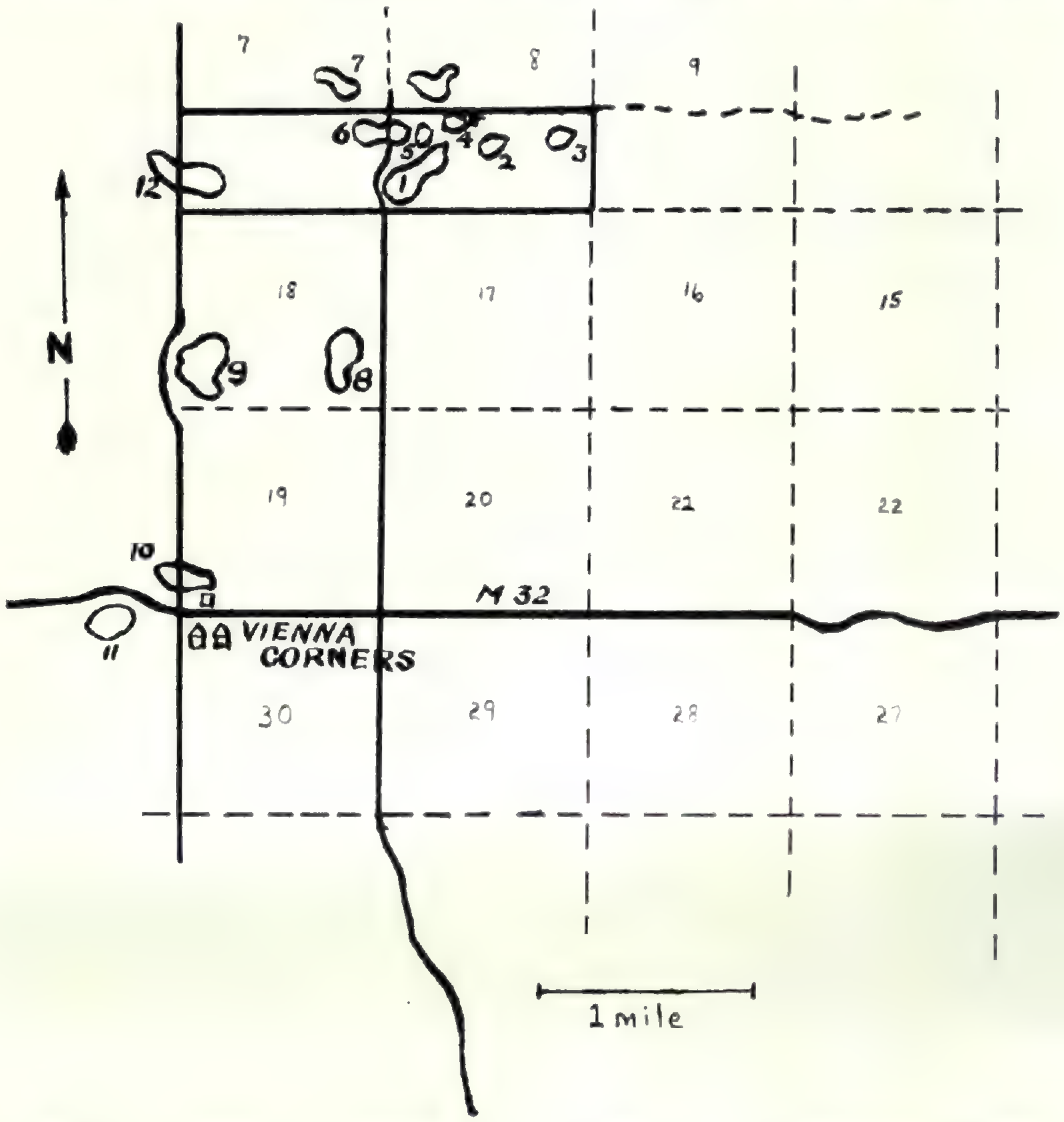


FIGURE 2. Portion of Township 30 N., Range 1 E., Montmorency County, Michigan, showing location of the explored bogs.

been covered; there are possibly others in which forma *heterophylla* will be discovered.

The locations of the explored bogs are shown on the accompanying map (Fig. 2). Forma *heterophylla* was found to occur in the bogs numbered 1, 2, 3, 8, and 9. A few of the plants found in bogs 6 and 7 appeared to be forma *heterophylla* but, as they were deeply shaded, final confirmation should be reserved until flowering specimens are seen. All the bogs are in Township 30 N., Range 1 E., Montmorency County, Michigan. Bogs 1, 2, 3, and 5 are in the south half of Section 8; bog 6 on the line between sections 7 and 8; bog 7 in the north half of Sect. 7; and bogs 8 and 9 are in Sect. 18 of the same township. All of the bogs are rather open *Picea-Larix* associations on Greenwood Peat soils (Veach et al. 1930). Living specimens of taxon *heterophylla* from these locations are in the author's greenhouse. Herbarium material, Case 900 to 908, and Bell 1548, will be deposited in the University of Michigan Herbarium, Gray Herbarium, the U. S. National Herbarium, and the University of North Carolina Herbarium.

To determine something of the ratio of occurrence of the red and the yellow forms, a series of counts was made. It must be stressed that any color comparisons must be taken on plants growing in the open. Only in complete sunlight does the coloring present develop fully, eliminating the confusion of greenish ecads which are genotypically red with the true anthocyanin-free forms. Plots 9 yards square were selected more or less at random from the open areas of bogs 1, 3, and 9. A record was made of the number of red-leaved plants and of the number of yellow-leaved plants with mature leaves in each plot. The findings are shown in the table below.

| *Bog* | *Plot* | *Red form* | *Yellow form* |
|---|---|---|---|
| 1 | 1 | 129 | 16 |
| — | 2 | 77 | 21 |
| 3 | 1 | 29 | 37 |
| — | 2 | 7 | 34 |
| 9 | 1 | 28 | 26 |
| — | 2 | 25 | 20 |

The data are too few to be considered as a final indication of the rate of occurrence of the two forms in Montmorency Co.,

Michigan. Yet they show that in some of the bogs, at least, forma *heterophylla* is very well developed. Especially interesting is the observation that in each of bogs 1, 3, and 9 there is a considerable number of plants of an orange-red color which do not fit the concept of either the typical red or the yellow form. In the above counts, however, such plants were treated arbitrarily as red. These orange-red plants, not found in bogs unless the yellow form was present also, lead me to believe that forma *heterophylla* is not behaving as a simple Mendelian recessive, and that the possibility of genetic blending must be considered. In order to obtain more information on the genetic nature of forma *heterophylla* I have initiated various greenhouse breeding experiments which should provide some insight into the situation, and which will be duly reported upon.

## Summary

The history and nature of *Sarracenia purpurea* forma *heterophylla* is briefly reviewed and maps of its known occurrence are presented. A number of new localities have been discovered in Montmorency Co., Michigan, over 600 miles west of the nearest localities heretofore recorded. Results of sample counts in various bogs where the two color forms occur together are given. A number of individuals in which the dominant color is orange-red suggest that genetic intermediates between the two forms may exist.

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# A CYTOTAXONOMIC STUDY OF THE GENUS HYMENOPAPPUS (COMPOSITAE)

Billie L. Turner

(*Continued from page 186*)

Following is a list of herbaria consulted during this study. The abbreviations used in citation of specimens are those recommended by Lanjouw and Stafleu (1952). Grateful acknowledgement is made to the curators concerned for the loan of material.

CAS California Academy of Sciences; DS Dudley Herbarium, Stanford University; GH Gray Herbarium of Harvard University; MO Missouri Botanical Garden; NY New York Botanical Garden; POM Herbarium of Pomona College; RM Rocky Mountain Herbarium, University of Wyoming; RSA Rancho Santa Ana Botanic Garden; SMU Southern Methodist University; TEX University of Texas; UC University of California, Berkeley; US United States National Herbarium, Smithsonian Institution; WS State College of Washington.

## TAXONOMY

**Hymenopappus** L'Hér. Hymenop. 1. 1788.

*Rothia* Lam., Jour. Hist. Nat. **1:** 16. 1792, non *Rothia* Schreb.

Biennial and perennial, subscapose to leafy-stemmed herbs from a single unbranched, obconical tap-root (in biennial species) or from a woody, much-branched tap-root bearing several crowns (in perennials); stems slender to stout, erect, angled and sulcate, often pithy; leaves alternate, forming a basal rosette, mostly bipinnately dissected to rarely simple or merely lobed, reduced up the stem, minutely impressed-punctate, with usually inrolled margins; inflorescence a few- to many-headed cymose panicle; heads discoid or radiate, subturbinate to broadly campanulate, on slender conspicuous peduncles; involucre of 6–14 subequal bracts in 2–3 series, these membranous at the apex or rarely throughout; receptacle dome-shaped to nearly flat, without chaff, except in *H. newberryi*; ray florets, when present, pistillate and fertile, with conspicuous white ligules; disk florets with regular corollas (at least the throat), yellow to white or less often reddish-purple, narrowed below into a slender, mostly glandular tube, and above this (after anthesis) an abruptly flaring, campanulate to funnelform throat, lobes equal, ovate, reflexed after anthesis; style branches more or less strongly flattened with obtuse, papillose tips, stigmatic lines marginal on the upper surface; anthers partially to completely exserted, shortly cordate-sagittate at base with ovate terminal appendages; achenes with 4 faces, obpyramidal to rarely incurved and diagonally compressed, the narrow base often shortly stipitate (in biennial species), faces 0–3-nerved, glabrous to densely pubescent with ascending or spreading hairs; pappus when present of 12–22 linear-oblong or broadly

ovate, obtuse, hyaline scales, usually with an included medial nerve; chromosome number, so far as known, with a base of $x = 17$.

Type species: *Hymenopappus scabiosaeus* L'Hér.

## KEY TO THE SPECIES OF *HYMENOPAPPUS*

1. Plants perennial, roots bearing several to many crowns; stem-leaves few, 0–10(–12); heads per stem few, 1–20 (–50); corolla throat 2–8 times as long as the lobes. . . . Series Perennes.
   2. Heads with conspicuous white rays.
      3. Receptacle chaffy; pappus 0.1 mm. long or obsolete. . 1. *H. newberryi.*
      3. Receptacle naked; pappus 0.4–0.6 mm. long. . . . . 2. *H. radiatus.*
   2. Heads eradiate (or in extremely rare specimens of *H. filifolius* var. *cinereus* with poorly developed rays).
      4. Leaves bipinnately dissected with narrow, linear divisions; achenes densely pubescent. . . . . 3. *H. filifolius.*
      4. Leaves simple or once-pinnate with broad divisions; achenes glabrate. . . . . 4. *H. mexicanus.*
1. Plants biennial, roots bearing a single crown (rarely 2 through injury); stem-leaves many, 10–100 (rarely less); corolla throat 1–2(–3) times as long as the lobes. . . . . Series Biennes.
   5. Heads with conspicuous white rays. . . . . 5. *H. biennis.*
   5. Heads eradiate.
      6. Achenes glabrous; pappus 0.2 mm. or less long. . 6. *H. flavomarginatus.*
      6. Achenes pubescent; pappus 0.2–2 mm. long.
         7. Corolla tube 1.5–2(–2.2) mm. long; basal rosette leaves bipinnately dissected, with mostly linear ultimate segments, 0.5–6 mm. wide; flowers yellow or white; corolla throat campanulate (very rarely funnelform).
            8. Flowers white; ultimate leaf segments narrowly linear, 0.5–1.5 mm. wide. . . . . 7. *H. tenuifolius.*
            8. Flowers yellow; ultimate leaf segments short, narrow to broad, 1–6 mm. wide.
               9. Leaf segments 2–6 mm. wide; leaves usually glabrous or less pubescent above; pappus 0.5–1(–1.2) mm. long. . . . . 8a. *H. flavescens* var. *flavescens.*
               9. Leaf segments 1–2 mm. wide; leaves usually evenly pubescent on both surfaces; pappus 1–1.5 mm. long (rarely less) 8b. *H. flavescens* var. *cano-tomentosus.*
         7. Corolla tube 2–3 mm. long; basal rosette leaves simple to bipinnate with broad ultimate segments 5–20 mm. wide; flowers white or vinaceous, never yellow, corolla throat funnelform (rarely campanulate).
            10. Basal rosette leaves once-pinnate to bipinnately parted; flowers white; pappus 0.2–0.8(–1) mm. long; plants of clayey soils in grasslands of Texas, Oklahoma, Kansas, and Nebraska, or sandy soils of the Upper Mississippi Valley and S.E. United States.

11. Peduncles with conspicuous ovate, membranous, petaloid bracts 5–14 mm. long (rarely less); involucral bracts white-membranous for half their length or more, 7–15 mm. long
9a. *H. scabiosaeus* var. *scabiosaeus*.
11. Peduncles ebracteate or with non-membranous, short, subulate scales; involucral bracts yellowish to white membranous for 2–4 mm. at the tip, 5–9 mm. long. . . 9b. *H. scabiosaeus* var. *corymbosus*.

10. Basal rosette leaves simple to once-pinnate; flowers vinaceous or reddish-tinged (rarely completely white); pappus 0.5–2 mm. long; plants in sandy soils of Louisiana and eastern and southern Texas.
12. Involucral bracts 6–12 mm. long, snowy-white membranous for half their length or more; pappus 0.5–1(–1.5) mm. long; stem-leaves (6–)8–16. . . . . 10a. *H. artemisiaefolius* var. *artemisiaefolius*.
12. Involucral bracts 5–7 mm. long, membranous for 1–2 mm. at the tip; pappus 1.5–2 mm. long; stem-leaves 2–8. . 10b. *H. artemisiaefolius* var. *riograndensis*.

### Series Perennes

### 1. **Hymenopappus newberryi** (Gray) Johnston

*Leucampyx newberryi* Gray, in Porter and Coulter, Synopt. Flora Colorado, p. 77, 1874. *H. newberryi* Johnston, Contrib. Gray Herb. n.s. **68:** 96. 1923. Type examined (GH): Colorado, "La Pagosa, July 29, 1860," McComb's Exped., *Dr. Newberry*. Isotypes (NY, US) give the locality as "La Pajosa" and the date as 1859.

Plants perennial, 20–60 cm. high, sparsely tomentose to nearly glabrate; rosette leaves 12–25 cm. long, 3–5 cm. wide, bipinnately dissected with narrow, linear, mostly flattened ultimate divisions, evenly and sparsely canescent on both surfaces to nearly glabrate, inconspicuously impressed-punctate; stem leaves 1–3(–5), much reduced; heads 3–8 per stem, broadly campanulate, 2–3 cm. in diameter, 60–150-flowered, on stout ultimate peduncles 6–15 cm. long; receptacle chaffy, dome-shaped, 5 mm. across, 3 mm. high; chaff deciduous, 5–9 mm. long, 2–5 mm. wide, partly to completely (near the periphery of heads) enclosing the achenes, minutely glandular to nearly glabrous, yellow-membranous, except near the base; principal involucral bracts 8–10 mm. long, 4–7 mm. wide, white or yellowish-white membranous for 2–4 mm. from the mostly obtuse tip; ray flowers 8, pistillate and fertile, tubular at the base for about 2 mm., with a conspicuous white (rarely pink) ligule, 14–20 mm. long, 8–15 mm. wide, 3-cleft at the apex, the sinus 2–3 mm. deep; disk flowers yellow, 3.5–4 mm. long, the tube sparsely glandular to nearly glabrate, 1.5–2 mm. long, throat campanulate 1.5–2 mm. long with lobes reflexed, 2–3 times longer than the lobes; style branches about 1 mm. long, short and flattened, with well defined stigmatic lines along the upper margins; achenes black, glabrous, narrowly obpyramidal, diagonally compressed

and strongly incurved, 3.5–4 mm. long; pappus minute (less than 0.1 mm. long) or absent; anthers not much exserted, 2.2–2.5 mm. long; $n = 17$.

DISTRIBUTION.—South-central Colorado and north-central New Mexico on clayey, principally igneous soils of mountainous regions, 7,000 to 10,000 ft., usually in open areas of pine, spruce or aspen woods (Fig. 24). June–September.

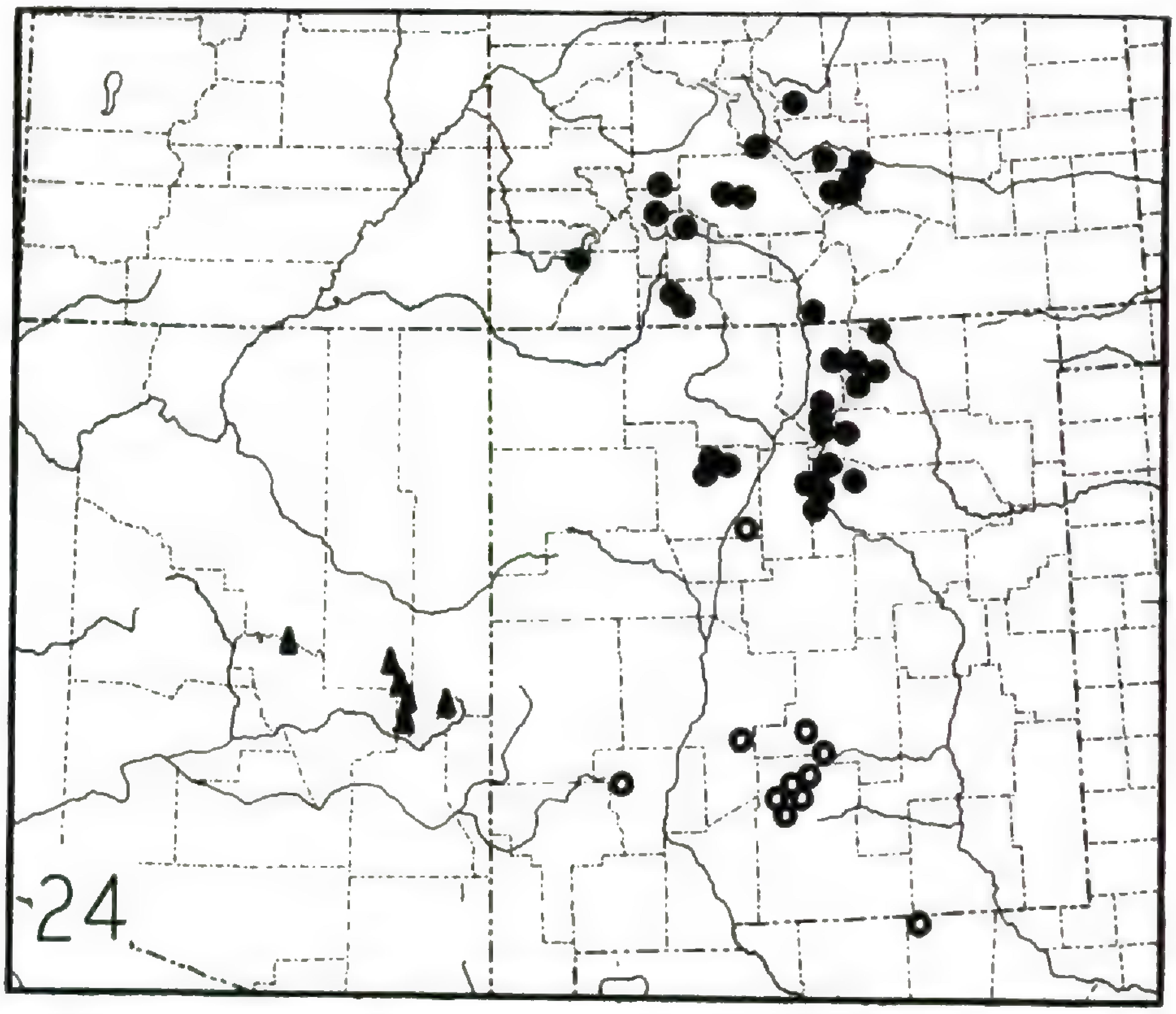
Gray described this species as being the sole member of a new genus *Leucampyx*, and placed it in the tribe Anthemideae of the Compositae. He recognized its resemblance to *Hymenopappus*, but apparently thought this a superficial one, assigning more significance to the technical characters of ray florets and chaff.

It was not until 1891, when Rose described the new species, *H. radiatus*, that this assignment of *Leucampyx* to the tribe Anthemideae was seriously questioned. The presence of an obviously rayed species of *Hymenopappus* no longer justified the tribal separation of *Leucampyx*, or even its maintenance as a separate genus. It remained for Johnston (1923) finally to reduce *Leucampyx* to generic synonymy under *Hymenopappus* and make the appropriate combination for the species. The work of the present author, both cytological and morphological, completely confirms this latter treatment.[7]

*Hymenopappus newberryi* has probably retained more primitive characters than any other member of the genus. Accordingly, from this species one may get an idea as to the main evolutionary trends that have occurred within the genus, foremost of which has been the progressive loss of parts such as chaff and rays. It seems probable that the *H. filifolius* complex had its origin from the *H. newberryi* line, or its immediate ancestor, at some early time. *H. radiatus* is thought to represent a more recently derived species which has differentiated directly from *H. newberryi*.

REPRESENTATIVE SPECIMENS.—**Colorado.** ARCHULETA CO.: Pagosa

[7] It appears likely that even the natural genetic barriers may rarely break down between *H. newberryi* and related species. John Beaman, of Harvard University, collected in 1954 several rather remarkable rayed specimens of what otherwise appeared to be *H. filifolius* var. *cinereus*. These collections were made 10.3 mi. east of Taos, New Mexico, and were taken from a population growing near that of typical *H. newberryi* (*Beaman 726*; GH, TEX). The plants in question have relatively short, poorly developed rays and are without chaff; however, the achenes and pappus are somewhat intermediate between the two taxa. If hybridization has been responsible for this variation, then its occurrence must be quite rare since similar variability was not detected in the numerous sheets examined from this area—nor was it detected in population studies during preliminary field work on the genus.



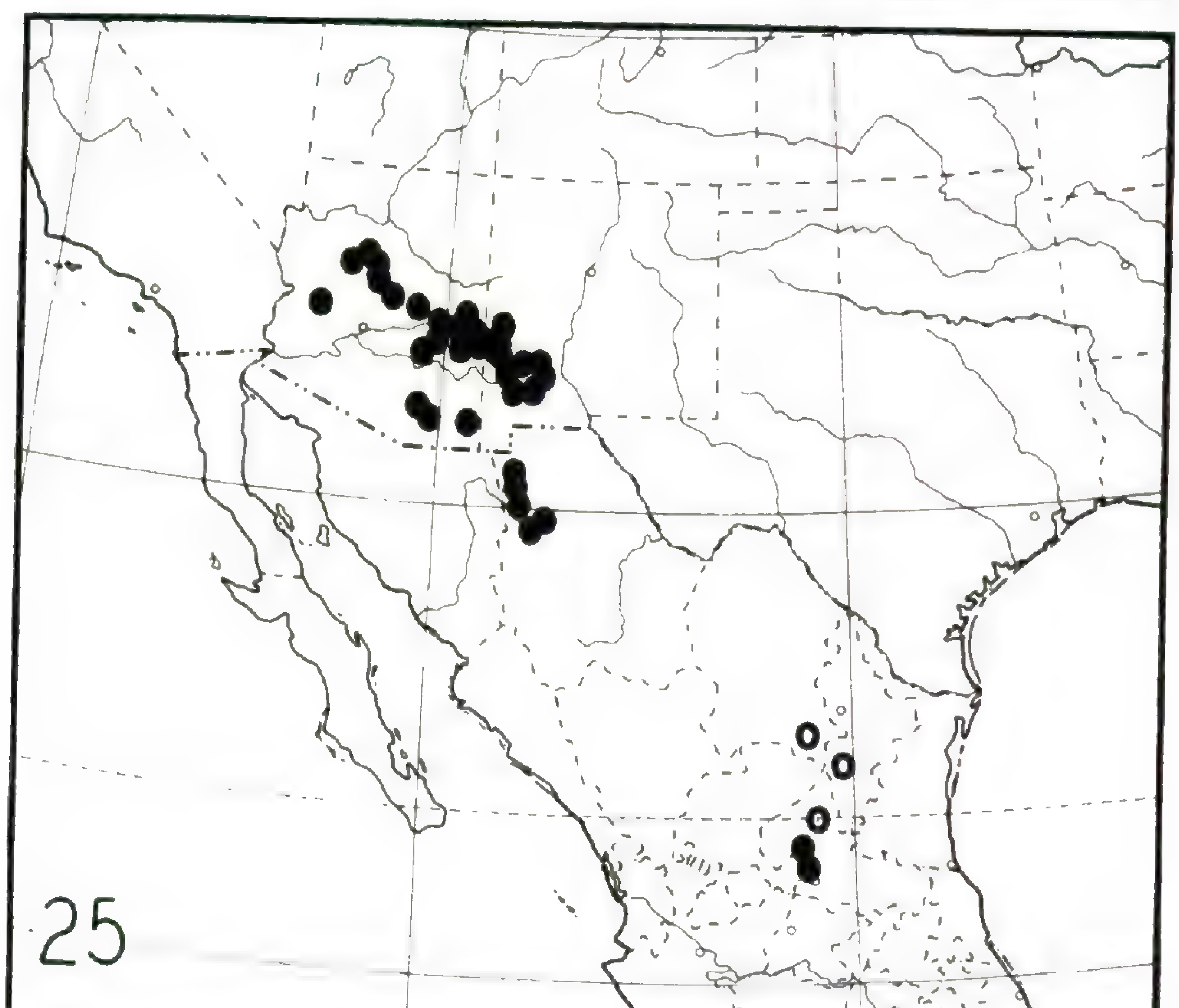




Fig. 24–25. Distribution of *Hymenopappus* species. Fig. 24. *H. radiatus* (triangles), *H. newberryi* (disks), and *H. biennis* (circles). Fig. 25. *H. mexicanus* (disks), and *H. flavomarginatus* (circles).

Springs, *Bethel, Willey & Clokey 4371* (CAS, DS, MO, NY, RM, UC, US, WS). CHAFEE CO.: Salida, (w/o date), *A. Lansing* (MO, UC). COSTILLA CO.: West Indian Cr., *Rydberg & Vreeland 5476* (NY, RM). CUSTER CO.: Hardscrabble Canyon, *Penland 1266* (CAS, US). DOLORES CO.: 5 mi. S. of Rico, *Maguire & Piranian 12925* (GH, UC). FREMONT CO.: near Canon City, 1871, *Brandegee 294* (MO, NY). GUNNISON CO.: 16 mi. E. of Lake City, Cebolla Cr., *Rollins 1420* (MO, NY). HINSDALE CO.: Spring Creek Pass, *Hitchcock, Rethke, & van Raadshooven 4101* (DS). MINERAL CO.: Rio Grande Nat'l. Forest, near Elliott Cr., June 18, 1911, *J. Murdock, Jr. 4623* (GH, MO, NY, UC, US). PARK CO.: South Park, 1871, *Brandegee 294* (MO, UC). SAGUACHE CO.: W. side of summit, Cochetopa Pass, *Weber 5775* (SMU, WS). **New Mexico.** COLFAX CO.: near Vermejo, *H. M. Hall R335* (UC). SANDOVAL CO.: La Cueva Springs, *Preece & Turner 2745* (SMU, WS). SAN MIGUEL CO.: Pecos R. Nat'l. Forest, Winsor's Ranch, *Standley 4003* (GH, MO, NY, RM, US). SANTA FE CO.: vicinity of Santa Fe, Lake Peak, *Arsène & Benedict 16016* (US). TAOS CO.: 10 mi. E. of Taos, *Rollins & Chambers 2415* (DS, GH, US).

### 2. **Hymenopappus radiatus** Rose

*Hymenopappus radiatus* Rose, Contrib U. S. Nat. Herb. **1:** 122. 1891. Type examined (US): "Willow Spring, Arizona," July (5–6), 1890, *Dr. E. Palmer 615*. According to Rose (1891), "Willow Springs is in the White Mountains near the pass leading to Ft. Apache."

Plants perennial, 30–45 cm. high, sparsely to densely tomentose; larger rosette leaves 8–14 cm. long, bipinnately dissected with linear, somewhat flattened, ultimate segments, 1–2 mm. wide; stem leaves 2–3, much reduced; heads 6–8 per stem, campanulate, 40–60-flowered, on ultimate peduncles 3–8 cm. long; principal involucral bracts 7–9 mm. long, 3–5 mm. wide, tomentose, yellow-membranous for 1–3 mm. from the acute to obtuse tip; receptacle dome-shaped, without chaff; ray flowers 8, tubular at the base for about 2 mm., extending into a conspicuous white ligule 14–16 mm. long, 5–10 mm. wide, usually with an emarginate or indistinctly 3-cleft apex; disk florets yellow, 3–4 mm. long, the tube 1.5–2 mm. long, sparsely glandular to nearly glabrous, the throat campanulate, 1.5 mm. long with lobes reflexed, 3 times longer than the acute lobes; achenes purplish-brown, 4–4.5 mm. long, obpyramidal and 4-sided, becoming diagonally compressed and incurved toward the periphery of the head; pappus of 14–18 small, obtuse scales, 0.4–0.6 mm. long; anthers partially exserted about 2.5 mm. long; $n = 17$.

DISTRIBUTION.—Endemic to Arizona; sandy tuffaceous or igneous soils on south-facing slopes in pine woods of east-central Arizona (Mogollon Rim and White Mountains), 7000–9000 ft. (Fig. 24). May–July.

*Hymenopappus radiatus* probably has its closest relative in *H. newberryi*. It differs from this latter species primarily by its non-chaffy receptacle, and less diagonally compressed, incurved achenes. The similarity of the two species is remarkable,

and for this reason it is believed that *H. radiatus* has been derived directly from or through *H. newberryi*, this derivation requiring only the loss of chaff from the receptacle.

Representative specimens.—**Arizona.** apache co.: Willow Springs, *E. Palmer 615* (gh, us). coconino co.: Mogollon Mts., *Collom 204* (gh, mo, ny, us). navajo co.: Cooley's Ranch (semi-open flats), *Goodding 1106* (ny, rm, us): Holbrook to Showlow, *J. Goodwin 112* (cas): Forestdale, 66 mi. S. of Holbrook, *W. Hough 69* (us); Fort Apache, 1893, *R. W. Hoyt* (ny); 9.5 mi. N. of White River, highway 73, *Preece & Turner 2686* (smu, ws); Fort Apache, 1892, *E. A. Shuttleworth* (us).

### 3. **Hymenopappus filifolius** Hook.

*Rothia filifolia* (Hook.) O. Ktze., Rev. Gen. **1:** 361. 1891.

Plants perennial, supscapose to rarely leafy-stemmed, 5–100 cm. high, densely tomentose to nearly glabrate; rosette leaves 3–20 cm. long, bipinnately dissected with linear, flattened or nearly filiform ultimate divisions, 2–50 mm. long, minutely impressed-punctate; stem leaves 0–12, usually much reduced upward; heads 1–60 per stem, subturbinate to broadly campanulate, 10–80-flowered, on ultimate slender peduncles 0.5–16 cm. long; receptacle naked (very rarely with 6–10 well developed chaffy scales); principal involucral bracts 3–14 mm. long, 2–5 mm. wide, white or yellowish-membranous for 1–4 mm. from the acute to obtuse tip; corollas yellow or less often white, 2–7 mm. long, tube densely glandular to nearly glabrous, 1–2.5 mm. long, throat campanulate, 1–3 mm. long with lobes reflexed, 2–8 times longer than the lobes; achenes obpyramidal, 4-sided, 3–7 mm. long, densely pubescent with hairs 0.2–3 mm. long; pappus of 12–22 linear oblong scales, 0.1–3 mm. long; anthers partially exserted, 1.6–4 mm. long; $n = 17, 34$.

Distribution.—Principally western United States in the Rocky Mts., Great Basin, Columbia Basin, northern Great Plains, and peripheral areas.

Key to the Varieties of H. filifolius[8]

1. Basal leaf axils without a dense tomentum, usually glabrous or sparsely tomentose; stem leaves 0 or 1(2); plants 5–30 (–45) cm. high.
   2. Ultimate peduncles 0.5–1.5 cm. long; corolla 2–3 mm. long; achenes 3–4 mm. long . . . . . 3a. var. *parvulus*.
   2. Ultimate peduncles 2–10 cm. long; corolla 3–5 mm. long, achenes 4–6 mm. long . . . . . 3b. var. *nudipes*.
1. Basal leaf axils with a dense conspicuous tomentum; stem leaves 0–12; plants 5–100 cm. high.
   3. Corollas 2–3 mm. long; florets 10–30 (avg. 20) per head; involucral bracts 3–7 mm. long; leaf tips of basal rosette 1–6 mm. long.

[8] Table 1 lists most of the important contrasts and should be used as a supplement to this key, which lists only the more conspicuous differences.

4. Stem leaves 0–3; pappus 0.1–0.8 mm. long; plants 5–20 cm. high . . . . . 3c. var. *luteus.*
4. Stem leaves 4–9; pappus 0.5–1.5 mm. long; plants 20–35 cm. high . . . . . 3d. var. *pauciflorus.*

3. Corollas 3–7 mm. long; florets (15–)20–70 per head; involucral bracts (5–)6–14 mm. long; leaf tips of basal rosette 3–50 mm. long.
5. Anthers 3–4 mm. long; corolla (3.5-)4–7 mm. long; pappus (1.2–)1.5–3 mm. long; achenes 5–7 mm. long; corolla throat 3–8 times as long as the lobes.
6. Flowers white; peduncles 8–16 cm. long; stem leaves 2–7; achene hairs 0.5–1 mm. long . . . . . 3e. var. *eriopodus.*
6. Flowers yellow or rarely white; peduncles 2–12 cm. long; stem leaves 0–6; achene hairs 1–2 mm. long.
7. Stem leaves (1)2–7; leaf tips of basal rosettes 5–30 mm. long; bracts 8–12(–14) mm. long; plants of low desert areas, 1000–5000 feet . . . . . 3f. var. *megacephalus.*
7. Stem leaves 0–3; leaf tips of basal rosettes 3–15 mm. long; bracts 6–10 mm. long; plants of higher elevations associated with juniper, oak or pine, 5000–9000 feet . . . . . 3g. var. *lugens.*

5. Anthers 2–3 mm. long; corolla 2.5–4.5 mm. long; pappus 0.2–3.0 mm. long; achenes 4–6 mm. long; corolla throat 2–5 times as long as the lobes.
8. Heads 5–60 per stem; stem leaves 3–8; leaf tips of basal rosettes 10–30 mm. long; throat 1.3–1.8 mm. long; plants of the northern Great Plains, E. of the continental divide . . . . . 3h. var. *polycephalus.*
8. Heads 1–40 per stem; stem leaves 0–12; leaf tips of basal rosettes 2–50 mm. long; throat 1.5–2.5 mm. long; plants of the Rocky Mts. or W. of continental divide (except for disjunct populations in the panhandle of Texas).
9. Stem leaves 5–12; leaf tips of basal rosettes 3–6 mm. long; endemic to S. W. Utah . . . . . 3i. var. *tomentosus.*
9. Stem leaves 0–5; leaf tips of basal rosettes 3–50 mm. long.
10. Pappus 0.2–1.0 mm. long; leaf tips of basal rosettes 15–50 mm. long; plants 30–100 cm. high; heads (2–)6–40 per stem; plants of Oregon and Washington . . . . . 3j. var. *filifolius.*
10. Pappus 0.6–3 mm. long; leaf tips of basal rosettes 2–30 mm. long; plants 5–50 cm. high; heads 1–6(–14) per stem; plants elsewhere.
11. Peduncles 3–15 cm. long; achene hairs 0.2–1.0 mm. long; pappus 1.5–3 mm. long; plants of the Great Basin . . . . . 3k. var. *nanus.*
11. Peduncles 1–6 cm. long; achene hairs 1–3 mm. long; pappus 0.6–2 mm. long; plants elsewhere.
12. Pappus 0.6–1.3 mm. long; stem leaves 0–2; plants of Idaho . . . . . 3l. var. *idahoensis.*
12. Pappus 1.5–2 mm. long; stem leaves (0) 2–4; plants not of Idaho . . . . . 3m. var. *cinereus.*

3a. **Hymenopappus filifolius** var. **parvulus** (Greene), comb. nov.

*Hymenopappus parvulus* Greene, Pl. Baker. **3:** 30. 1901. Isotype examined (POM): "Gunnison," Colorado, 7680 ft., July 17, 1901. *C. F. Baker 449.* Isotypic material of *Baker 449* is not widely distributed. Only the one sheet was seen by the author. Cotype material, *Baker 840*, is typical of the variety and is found in several herbaria.

Plants perennial, 10–25 cm. high; stems unbranched, very sparsely grayish-green tomentose to reddish-glabrate; larger rosette leaves sparsely

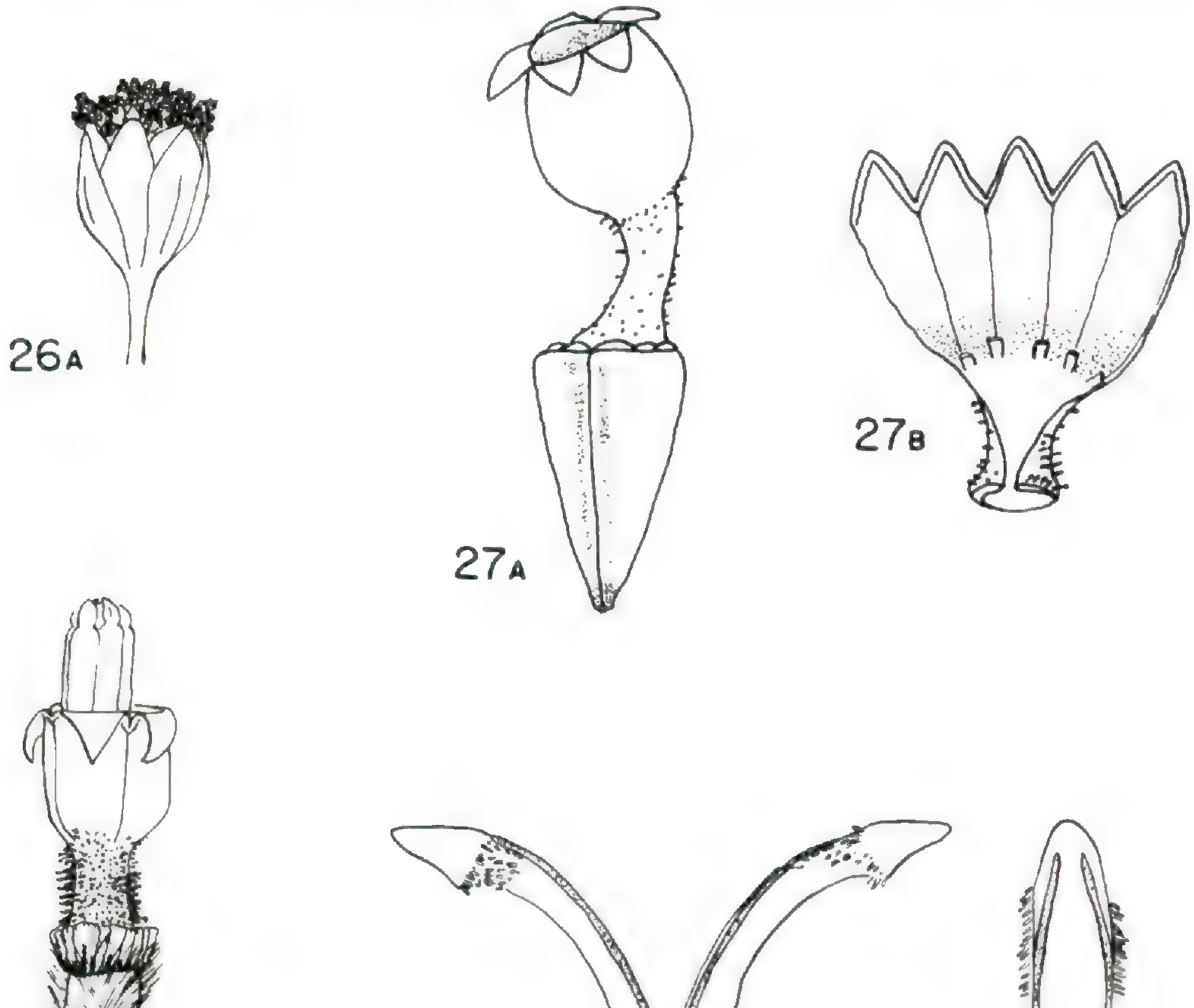



FIG. 26–27. Floral morphology of *Hymenopappus* species. Fig. 26. *H. filifolius* var. *filifolius* (*T. 2293*); (a) head, × 1.5; (b) floret, × 8; (c) pappus scales, × ca. 40; (d) style branches, × ca. 45; (e) upper surface of style branch, × ca. 45. Fig. 27. *H. mexicanus* (*Rusby 179*); (a) peripheral floret. × 8; (b) corolla opened, showing equal lobes, × 8.

pubescent to glabrate, without a dense tomentum in the axils, 3–10 cm. long, 2–5 cm. wide, typically once-pinnate with a few scattered, linear, secondary divisions, 0.5–1 mm. wide, 5–20 mm. long, petiole conspicuous, composing ½–⅔ of the leaf; stem leaves 0–2, much reduced; heads 3–10 (rarely–15) per stem, subturbinate, 10–18-flowered, on very short peduncles 5–15 mm. long; principal involucral bracts glabrate to pubescent below, 4–8 mm. long, 2–3 mm. wide, yellow-membranous for 1–2 mm. from the acute tip (very rarely red-tinged); corollas yellow, 2–3 mm. long, tube densely glandular, 1–1.5 mm. long, throat campanulate-tubular, 1.5–1.8 mm. long with lobes reflexed; achenes 3.5–4 mm. long, pubescent with hairs about 1 mm. long; pappus of 14–16 linear oblong scales, 1–1.8 mm. long; anthers partly exserted, about 2 mm. long; $n = 17$.

Distribution.—Sandy or rocky, gravelly slopes on foot-hills (5500–8600 ft.) in sunny, exposed situations of central and southwestern Colorado (Fig. 28). Late June–August.

*Hymenopappus filifolius* var. *parvulus* is one of the most distinct varieties of the *H. filifolius* group, being distinguished by its congested, small, few-flowered heads and by its almost complete lack of wool in the axils of basal rosette leaves (this latter character is shared only by var. *nudipes* in this complex).

In the garden at Pullman, Washington, all these distinguishing characters appeared again on ten plants grown from seed collected in the field (*Preece & Turner 2802*), except that there was a tendency toward a more leafy rosette and generally increased size of vegetative organs.

Johnston (1923), included this variety within his *H. filifolius* var. *cinereus* with some reservation, stating, "*Hymenopappus parvulus* is referred here with great doubt, and I am inclined to believe that it probably is specifically distinct as it differs from the variety *filifolius* [sic] in its subscapose habit and small heads."

This variety seems closest, morphologically, to the variety *nudipes* from which it differs in the fewer number, and smaller size of the florets, and its shorter-peduncled, more congested inflorescence.

Though spatially the ranges of var. *parvulus* and var. *cinereus* overlap, the two are kept separate for the most part by altitudinal and topographic differences, *H. filifolius* var. *parvulus* being found usually at lower elevations on bare, sandy or gravelly slopes; var. *cinereus* occurs at somewhat higher elevations in clays and silts, mostly on vegetated valley bottoms and hillsides. However, the two probably cross readily, and evidence

TABLE 1 Analysis of Differences between Varieties of Hymenopappus filifolius

| *Variety* | *Chromosome number n* | *Corolla color* | *Bracts red tipped* | *Corolla length mm.* | *Throat length mm.* | *Throat/lobe ratio* | *Number florets* | *Heads per stem* | *Peduncle length cm.* |
|---|---|---|---|---|---|---|---|---|---|
| polycephalus | 34 | yellow | − | 3.0–3.5 | 1.3–1.8 | 2–3 | 20–50 | 5–60 | 2–8 |
| cinereus | 17 | yellow-white | −(+) | 3.0–4.5 | 1.5–2.0 | 2.5–4 | 25–40 | 1–6 | 1–6 |
| luteus | 17 | yellow | −, + | 2.0–3.0 | 1.0–2.0 | 2.5–4 | 15–25 | 5–50 | 1–7 |
| pauciflorus | 17 | yellow | − | 2.0–3.0 | 1.0–1.6 | 2–3 | 10–30 | 2–15(–30) | 2–6 |
| tomentosus | 17 | yellow | −, + | 3.0–4.5 | 1.5–2.5 | 3–4(6) | 30–40 | 4–14 | 1–6 |
| megacephalus | — | yellow | −, + | 4.0–7.0 | 2.0–5.0 | 3–6 | 25–60 | 3–10 | 2–10 |
| eriopodus | — | white | −, + | 4.0–5.0 | 2.0–3.0 | 3–5 | 30–60 | 3–8 | 8–16 |
| lugens | 17, 34 | yellow-white | +(−) | 4.0–6.0 | 2.0–3.0 | 3–8 | 20–72 | 3–8 | 2–12 |
| nanus | 17 | light yellow | −(+) | 3.0–4.0 | 1.5–2.0 | 2–4 | 30–60 | 1–6 | 3–15 |
| idahoensis | 17 | yellow | −(+) | 3.2–4.5 | 1.5–2.0 | 3–4 | 25–70 | 4–14 | 1–6 |
| filifolius | 17 | yellow | −(+) | 2.5–4.5 | 1.6–2.5 | 2.6–5 | 15–45 | (2–)6–40 | 1–15 |
| nudipes | 17 | yellow | −(+) | 3.0–5.0 | 1.5–2.5 | 2–4(–5) | 10–35 | 1–10 | 2–10 |
| parvulus | 17 | yellow | − | 2.0–3.0 | 1.5–1.8 | 2–3 | 10–20 | 3–10 | 0.5–1.5 |

| *Variety* | *Tomentum in leaf axils* | *Achene length mm.* | *Pappus length mm.* | *Achene hair length mm.* | *No. stem leaves* | *Length of leaf apex mm.* | *Plant height in cm.* | *Bract length mm.* | *Anthers mm.* |
|---|---|---|---|---|---|---|---|---|---|
| polycephalus | + | 4.0–5.0 | 0.6–1.8 | 1.0–2.0 | (2)3–8 | (4–)10–30 | 20–60 | 5–8 | 2.5–3 |
| cinereus | + + | 4.0–6.0 | 1.5–2.0 | 1.0–3.0 | (0–1)2–4 | 2–8(–15) | 15–40 | 6–9 | 2–3 |
| luteus | + + | 4.0–5.0 | 0.1–0.8 | 1.0–2.0 | 0–3 | 1–5 | 5–20 | 5–7 | 2 |
| pauciflorus | + | 3.0–4.5 | 0.5–1.5 | 1.0–2.0 | 4–9 | 2–6 | 20–35 | 3–6 | 1.6–2 |
| tomentosus | + + | 4.5–5.0 | 0.8–1.8 | 0.5–1.0 | 5–12 | 3–6 | 30–60 | 7–10 | 2.5–3 |
| megacephalus | + | 5.0–7.0 | 1.5–3.0 | 1.0–2.0 | (1)2–6 | 5–30 | 30–70 | 8–12(–14) | 3–4 |
| eriopodus | +(++) | 5.0–6.0 | 1.5–2.0 | 0.5–1.0 | 2–7 | 6–40 | 45–70 | 7–10 | 3–3.5 |
| lugens | + + | 5.0–6.0 | 1.2–2.5 | 1.0–2.0 | 0–3 | 3–15 | 20–60 | 6–10 | 3–3.5 |
| nanus | + + | 4.5–5.5 | (1–)1.5–3 | 0.2–1(–2) | 0–2(3) | 3–15 | 5–50 | 6–9 | 2.5–3 |
| idahoensis | + + | 4.5–6.0 | 0.6–1.3 | 1.0 | 0–2 | 6–30 | 10–45 | 7–9 | 2.5–3 |
| filifolius | + +(+) | 4.5–6.0 | 0.2–1.0 | 0.4–1.0 | (0–)2–5 | 15–50 | 30–100 | 6–10 | 2.5–3 |
| nudipes | − | 4.0–6.0 | 1.5–2.5 | 0.5–1.2 | 0–1(2) | 6–40 | 5–45 | 6–10 | 2.5–3 |
| parvulus | − | 3.5–4.0 | 0.6–1.8 | 1.0 | 0–1(2) | 3–20 | 10–25 | 4–8 | 2.0 |

of introgression of one into the other may be seen at several places in the field, as well as among herbarium specimens.

REPRESENTATIVE SPECIMENS.—**Colorado.** DOLORES CO.: boundary of Montezuma Nat'l. Forest, T39 N, R14 W, *M. Ownbey 1475* (DS, GH, MO, NY, RM, UC, WS). GRAND CO.: Sulphur Springs, *J. Wolf 476* (US). GUNNISON CO.: Gunnison, *C. F. Baker 840* (DS, GH, MO, NY, POM, RM, UC, US, WS). MINERAL CO.: 4.7 mi. S.W. of Creede, *M. & G. B. Ownbey 3040* (NY, RSA, SMU, WS). PARK CO.: South Park, 1871, *T. Meehan* (NY). SAGUACHE CO.: hills about Elko, highway 50, *Preece & Turner 2816* (SMU, WS).

### 3b. **Hymenopappus filifolius** var. **nudipes** (Maguire), comb. nov.

*Hymenopappus nudipes* Maguire, Am. Midl. Nat. **37:** 143. 1947. Type examined (NY): Utah, Kane Co., 15 mi. N. of Orderville, frequent under yellow pine and manzanita, sandy soil, 5800 ft., June 15, 1940, *B. Maguire 18740.*

*Hymenopappus nudipes* var. *alpestris* Maguire, Am. Midl. Nat. **37:** 144. 1947. Type examined (NY): Utah. Iron Co. Cedar Breaks Rim, 10,400 ft., June 23, 1940, *B. Maguire 19023.*

Plants perennial, 5–30(–45) cm. high, sparsely tomentose to glabrate, up to 70 crowns from a single tap-root, larger rosette leaves 6–13 cm. long, 3–5 cm. wide, typically once-pinnate or with a few secondary divisions, these flattened and linear, 1–2 mm. wide, petiole frequently reddish-glabrate at base, comprising ½–⅔ of the leaf, without a dense tomentum in the axil; stem leaves 0 or 1(2), much reduced; heads campanulate, 1–12 per stem, 15–35-flowered, on ultimate peduncles 2–10 cm. long; principal involucral bracts 6–10 mm. long, 2–5 mm. wide, yellow, or commonly reddish-membranous for 1–2 mm. from the obtuse tip; corollas yellow, 3–5 mm. long, tube glandular, 1.5–2.5 mm. long, throat campanulate, 1.5–2.5 mm. long with lobes reflexed; 2–4 times longer than the lobes; achenes 4.5–6 mm. long, pubescent with hairs 0.5–1.2 mm. long; pappus of 14–16 linear-oblong scales, 1.5–2.5 mm. long (rarely less); anthers about one-half exserted 2.5–3 mm. long; $n = 17$.

DISTRIBUTION.—Barren, mostly exposed, gravelly, sandy, and sandy-clay soils, principally in Utah along the eastern slopes of the Wasatch Mountains southwestward to Kane Co., 6000-11,500 feet (Fig. 28). June–July.

*Hymenopappus filifolius* var. *nudipes* is probably most closely related to var. *nanus* or var. *parvulus*. It differs from the former in the fewer florets, more glabrate leaves, and lack of a dense tomentum in the rosette leaf axils; it differs from the latter in having larger florets and heads, larger pappus, and a more open, longer-peduncled inflorescence. Thus var. *nudipes* seems to stand intermediate between these two varieties. The same situation exists as concerns their geographical distribution;

var. *parvulus* occurs on the dry barren foothills of central and southwestern Colorado and var. *nanus* occurs to the west on the Great Basin ranges.

The range of var. *nudipes* overlaps that of var. *lugens* in the southwestern part of Utah. Apparently, the two are kept separate, for the most part, by ecological factors; for example, var. *nudipes*, at the type locality, occurs on sandy-clay, barren slopes, in what appear to be "pure" colonies. Not more than one-fourth of a mile distant and at somewhat higher elevations,

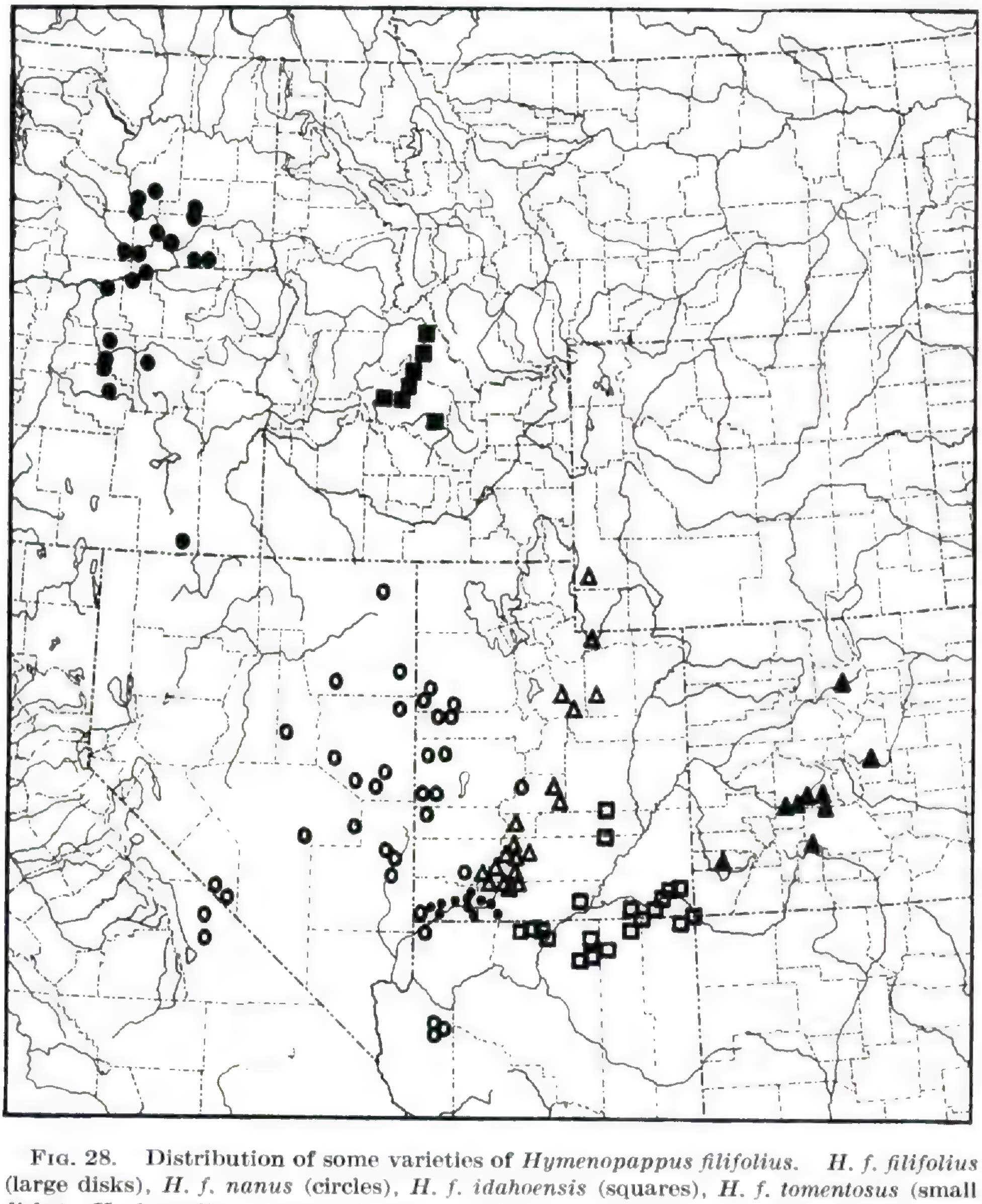


Fig. 28. Distribution of some varieties of *Hymenopappus filifolius*. *H. f. filifolius* (large disks), *H. f. nanus* (circles), *H. f. idahoensis* (squares), *H. f. tomentosus* (small disks), *H. f. nudipes* (open triangles), *H. f. pauciflorus* (open squares), and *H. f. parvulus* (triangles).

a "pure" colony of var. *lugens* may be found growing on a flat mesa top in sandy-gravelly soil. However, evidence of extra-varietal contamination or introgression is not completely lacking. Occasional plants, in the field as well as on herbarium sheets, are seen which have considerable amounts of tomentum in the leaf axils (but not so much as var. *lugens*), probably indicating gene-flow or introgression from that variety (*Daly 7-BD*).

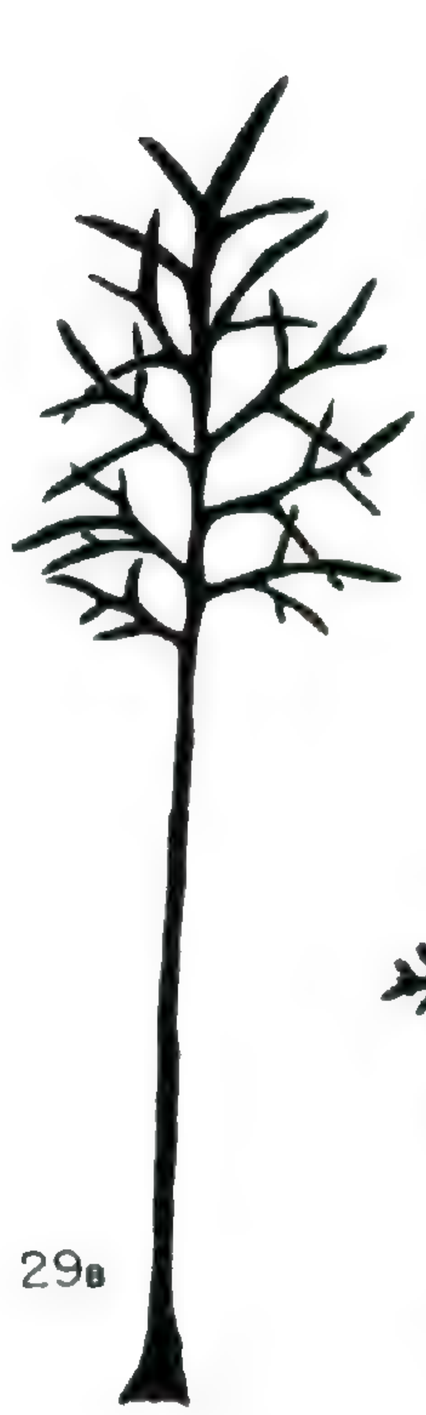
At lower elevations in the Bryce Canyon region where *Hymenopappus filifolius* var. *nudipes* comes close to the western-most range of var. *cinereus*, nearly complete intergradation of these two varieties occurs (*Goodman & Hitchcock 1599; Preece & Turner 2476*).

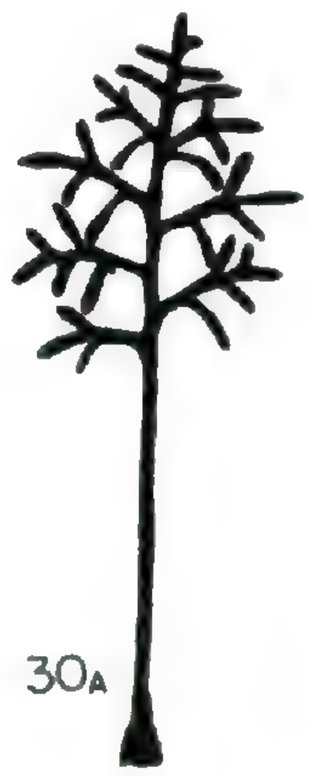
*Hymenopappus nudipes* var. *alpestris* is considered to be a form of var. *nudipes* which occurs at somewhat higher elevations (10,000–11,500 ft.). It cannot be separated from other material of the variety by any constant, particular characters, though there is a general tendency for a smaller, more pubescent, later-flowering plant to develop at these altitudes. Completely transitional types occur from higher to lower elevations, and comparison of several collections from the type locality of Maguire's "ecotype" shows considerable variability in their characters.

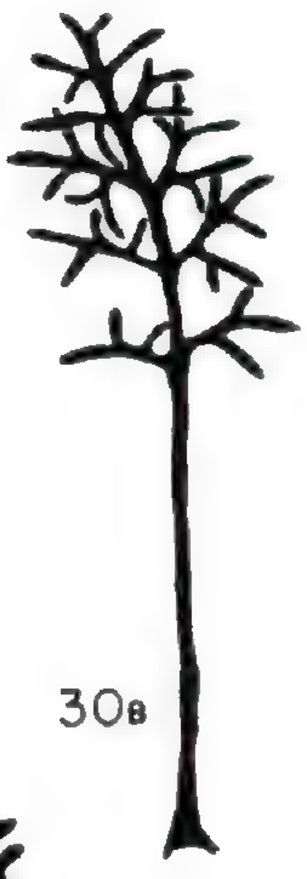
REPRESENTATIVE SPECIMENS.—**Utah.** DUCHESNE CO.: about 18 mi. W. of Duchesne, highway 40, *Ferris 11326* (CAS, DS). GARFIELD CO.: 6 mi. N. of entrance to Bryce Canyon, *Goodman & Hitchcock 1599* (CAS, DS, GH, MO, NY, RM, UC). IRON CO.: 1 mi. E. of Museum in narrow belt along Rim, 10–100 feet wide, Cedar Breaks, *Preece & Turner 2436* (WS). KANE CO.: 15 mi. N. of Orderville, *Maguire 18740* (GH, NY, MO, UC, US, WS). PIUTE CO.: Brigham Peak, Marysvale, Aug. 29, 1894, *M. E. Jones 5958k* (POM, US). SEVIER CO.: Sawtooth, 15 mi. up Salina Canyon *Keck 680* (CAS, GH, POM, UC). SUMMIT CO.: Uintah Mts., Mt. Elizabeth, Cow Hollow, Aug. 12, 1928, *G. J. Goodman 552* (RM). UTAH CO.: Soldier Summit, July 25, 1947, *Holmgren, Boyle, & Ballenger 7055* (UC). **Wyoming.** LINCOLN CO.: Fossil, Aug. 9, 1895, *G. W. Letterman* (MO). (There are two specimens on this sheet representing two taxa, var. *nudipes* and *H. filifolius* var. *polycephalus*, neither of which has been collected near this locality. It seems more probable that the plant of var. *nudipes* goes with the label since the variety has been collected at Mt. Elizabeth, Utah, only a short distance across the border from southwestern Wyoming.)

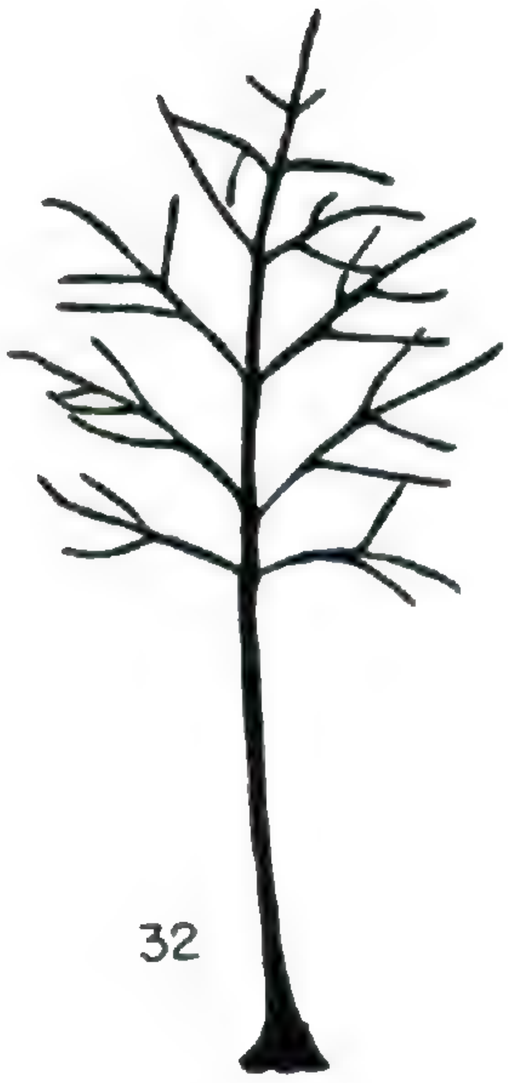
### 3c. **Hymenopappus filifolius** var. **luteus** (Nutt.), comb. nov.

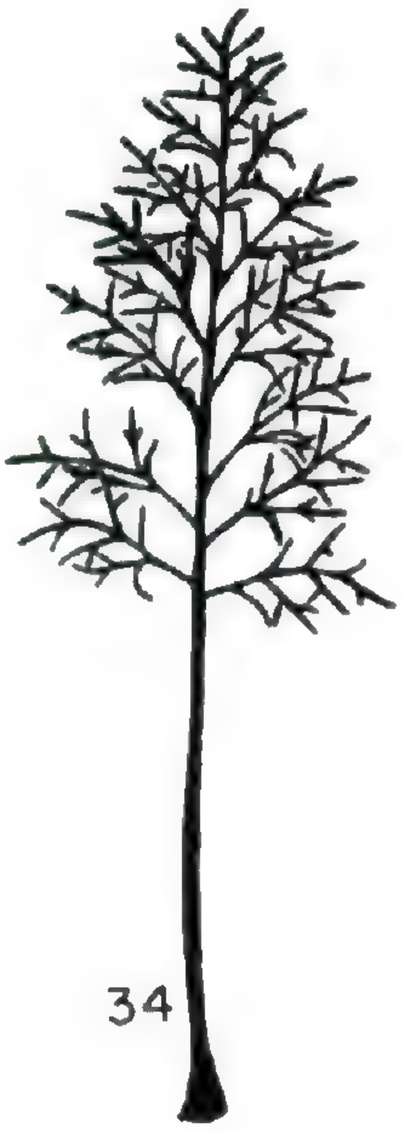
*Hymenopappus luteus* Nutt., Trans. Am. Phil. Soc. **7:** 374. 1840. Probable isotype examined (GH): "Rocky Mts., Nuttall!" In the type







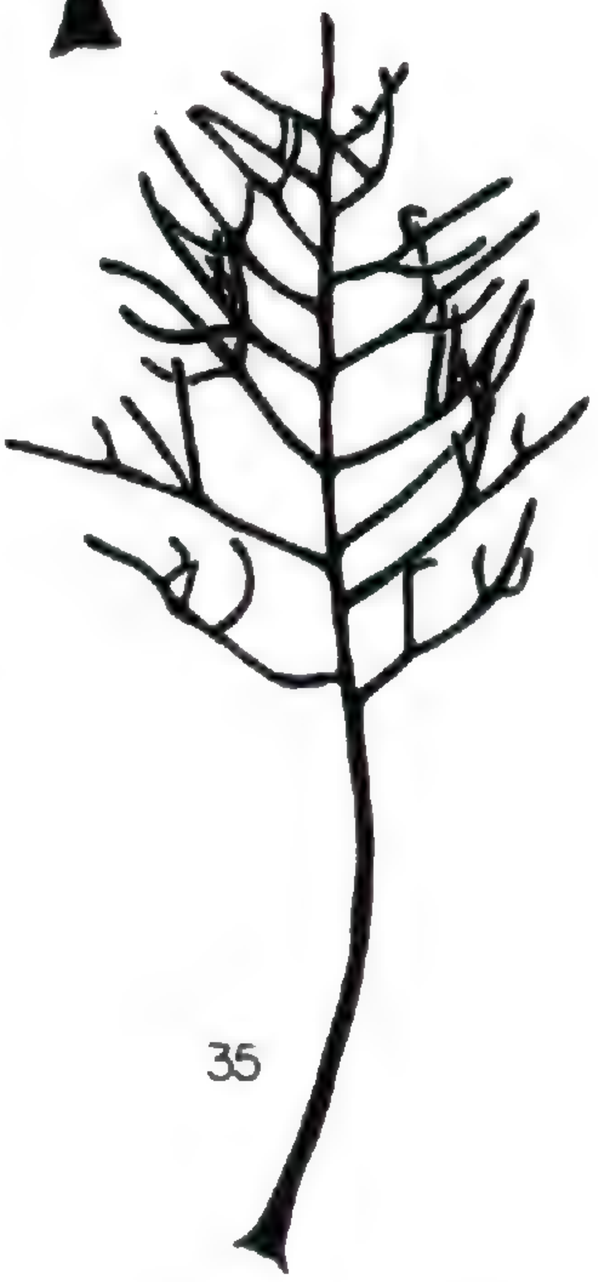




**Fig. 29–35.** Leaf silhouettes of *Hymenopappus filifolius* varieties. **Fig. 29a, b.** *H. f. lugens*, yellow-flowered tetraploid race (*P. & T. 2614*). **Fig. 30a, b.** Same, yellow-flowered diploid race (*P. & T. 2645*). **Fig. 31a, b, c.** *H. f. luteus* (*P. & T. 2873*). **Fig. 32.** *H. f. nanus* (*P. & T. 2608*). **Fig. 33.** *H. f. parvulus* (*P. & T. 2802*). **Fig. 34.** *H. f. cinereus* (*P. & T. 2739*). **Fig. 35.** *H. f. idahoensis* (*P. & T. 2378*). All × ca. 1/3.

description Nuttall gave the following locality, "Rocky Mts., towards the Colorado of the west, particularly on Ham's Fork." The type was probably collected in what is now Lincoln Co., Wyoming.

Plants perennial, with slender stems, 10–30(–45) cm. high, densely tomentose to nearly glabrate; rosette leaves 3–6 cm. long, 1–1.5 cm. wide, bipinnately dissected with many very short divisions, 1–3 mm. long (resembling *Achillea*), the petiole composing less than ½ the leaf length; stem leaves 0–4, commonly 2, becoming reduced upward; heads 5–50 per stem, commonly 10 or more, campanulate, 15–30-flowered, on slender, often reddish, ultimate peduncles 1–7 cm. long; principal involucral bracts 5–7 mm. long, 2–3 mm. wide, yellow to reddish-membranous for 1–2 mm. from the acute to obtuse tip; corollas yellow, 2–3.5 mm. long, the tube densely glandular, 1–2 mm. long, the throat campanulate, 1.2 mm. long with lobes reflexed, (2–)3–4 times as long as the lobes; achenes 4–5 mm. long, evenly pubescent with hairs 1–2 mm. long; pappus of 14–18 linear oblong scales, 0.1–0.8 mm. long; anthers partially exserted, about 2 mm. long; $n = 17$.

Distribution.—Gravelly, calcareous or sandy foothills in the basin areas of central and southwestern Wyoming, extending into adjacent Utah (Uinta Basin) and Moffat Co., Colorado (Fig. 36). June–July.

*Hymenopappus filifolius* var. *luteus* is a very distinct, easily recognized variety over a large part of its range; however, the characters of the variety intergrade completely with those of var. *cinereus* in Moffat Co., Colorado, and, to a lesser degree, with the characters of var. *megacephalus* in the Uinta Basin, Utah (*E. H. Graham 8300, 9144; Ripley & Barneby 7793*).

*Hymenopappus filifolius* var. *luteus* is somewhat variable as to size of vegetative organs and number of heads produced, even within the same race, when habitats differ. *Preece & Turner 2872, 2873, 2874* (all at ws) represent specimens that were collected from along a roadside in an old bladed area, from deeper soiled shallow ditch, and from an unbladed adjacent hillslope respectively. It was thought at first that there might be some conspicuous genetic difference between the individuals comprising the three groups since there seemed to be considerable phenotypic variation, this appearing somewhat correlated with the habitats mentioned. Seed was collected from the extreme individuals of the groups (*2872, 2873*) within the race, and ten plants of each of these groups were grown from seed in a uniform garden. The resulting progeny (20 individuals) were essentially of the same type, being quite uniform in height, number of heads produced, and other features. Meiosis appeared to be normal.

Representative specimens.—**Colorado.** moffatt co.: 10 mi. W. of Maybell, *Porter 3608* (ds, gh, rm, uc, us). **Utah.** daggett co.: 1.5 mi. S. of Manila, *M. Ownbey 3255* (ws). uintah co.: N.W. of mouth of Split Mt. Canyon, above Island Park, *Graham 9144* (gh, mo). **Wyoming.** albany co.: Sheep Cr., Aug. 21, 1899, *C. Schuckurt* (?) (ny). big horn co.: Trapper Cr., *C. Finley 23* (rm). carbon co.: Fort Steele, *Nelson 7150* (gh, mo, ny, pom, rm, us). lincoln co.: E. of Opal, *Ripley & Barneby 7864* (cas). natrona co.: Satanka Fm., near Alcova, *Porter 4485* (gh, rm, rsa). sublette co.: 6 mi. E. of Big Piney, *E. B. & L. B. Payson 2594* (gh, mo, ny, pom, rm, uc). sweetwater co.: Granger, *Nelson 4695* (ny, rm, uc, ws). uinta co.: 16 mi. S.E. of Lyman, *Rollins 1674* (ds. gh, mo, ny, uc, us).

3d. **Hymenopappus filifolius** var. **pauciflorus** (Johnston), comb. nov.

*Hymenopappus pauciflorus* Johnston, Contrib. Gray Herb. n.s. **68:** 97. 1923. Type examined (gh): Utah. "along San Juan River, near Bluffs," 1200–1500 m., Aug. 25–29, 1911, *P. A. Rydberg & A. O. Garrett 9951* (Isotype ny).

Plants perennial, 20–35 cm. high, tomentose to nearly glabrate, usually the much-branched stems from several crowns, giving a bushy aspect to the whole plant; rosette leaves 5–7 cm. long, 1–2 cm. wide, canescent to loosely tomentose, bipinnately dissected with short, linear divisions 1–5 mm. long, 0.5–1 mm. wide (resembling those of var. *luteus*); stem leaves 3–9, becoming reduced upward; heads 2–15(–30) per stem, subturbinate, 10–30-flowered, on ultimate slender peduncles 2–6 cm. long; principal involucral bracts 3–6 mm. long, 2–3 mm. wide, pubescent to nearly glabrate, yellow-membranous for about 1 mm. from the tip; corollas yellow, 2–3 mm. long, the tube densely glandular, 1–2 mm. long, the throat 1–1.6 mm. long with lobes reflexed, 2–3 times longer than the lobes; achenes 3–4.5 mm. long, evenly pubescent with hairs 1–2 mm. long; pappus of 14–18 linear oblong scales, 0.5–1.5 mm. long; anthers partially exserted, 1.6–2 mm. long; $n = 17$.

Distribution.—Low desert areas in sandy soils of southeastern Utah, adjacent Arizona and the southwestern-most corner of Colorado (San Juan R.), 3800–5500 feet (Fig. 28). May–September.

*Hymenopappus filifolius* var. *pauciflorus* seems to have its closest relationship with varieties *luteus* and *cinereus*. In many respects it stands intermediate between the two. It differs from the former in having higher, more leafy stems with fewer heads, and from the latter in its more numerous heads which contain fewer, smaller florets.

There seems to be considerable intergradation between *H. filifolius* var. *pauciflorus* and var. *cinereus* in the southeastern part of Utah at intermediate elevations where the two taxa

overlap in their ranges (*Standley 7334*); however, they are kept separate, for the most part, by altitudinal barriers. Var. *cinereus* occurs on the mountain ranges, in this area, from 5000–10,000 feet; var. *pauciflorus*, as noted above, occurs at lower altitudes from 3800–5500 feet. In addition, var. *pauciflorus* grades into var. *tomentosus* in southwestern Utah (*S. B. Benson 146*) and locally, in parts of its range, into var. *megacephalus*. The mechanism or method whereby this latter variety retains its distinctiveness in the range of var. *pauciflorus* is not known. Apparently they occur at similar elevations, and evidence of introgression or contamination is seen in several collections (*J. T. Howell 24714; M. E. Jones*, May 19, 1914). In spite of the considerable intergradation with adjacent or overlapping varieties, var. *pauciflorus* retains a remarkable degree of uniformity throughout its range, especially in regard to its small florets and leafy stems.

The "*filifolius* complex" in this area obviously needs extensive field study and detailed chromosomal investigation.

REPRESENTATIVE SPECIMENS.—**Arizona.** APACHE CO.: N. end of Carrizo Mts., *Standley 7334* (US). COCONINO CO.: 1.5 mi. below Lee's Ferry, *Cutler 3152* (DS, GH, MO, NY, SMU). NAVAJO CO.: Navajo Reservation, *Vorhies 130* (GH, MO, NY, UC). **Colorado.** MONTEZUMA CO.: San Juan Valley, *Brandegee 1268* (MO, NY, UC). **Utah.** EMERY CO.: San Rafael Swell, May 19, 1914, *M. E. Jones* (POM). KANE CO.: Kaiparowitz Plateau, Apr., 1939, *Tompkins* (CAS). SAN JUAN CO.: along San Juan R., near Bluffs, *Rydberg & Garrett 9950* (NY, RM, UC, US). WAYNE CO.: 18 mi S. of Hanksville, June 10, 1947, *Stoddart & Cook* (UC).

3e. **Hymenopappus filifolius** var. **eriopodus** (Nelson), comb. nov.

*Hymenopappus eriopoda* Nelson, Bot. Gaz. **37:** 274–275. 1904. Type examined (RM): Utah. "Rocky volcanic draws. Diamond Valley," May 19, 1902, *L. N. Goodding 880.*

Plants perennial, 40–80 cm. high, sparsely to densely tomentose below, becoming glabrate above; principal rosette leaves sparsely tomentose to glabrate, 10–20 cm. long, 3–7 cm. wide, bipinnately dissected with mostly filiform, ultimate divisions, 10–20 mm. long, 0.4–1 mm. wide; stem leaves (2) 3–7, mostly glossy green and glabrate; heads 3–8 per stem, subturbinate to campanulate, 30–60-flowered, on slender ultimate peduncles 8–16 cm. long (rarely less); principal involucral bracts 7–10 mm. long, 2–4 mm. wide, sparsely tomentose to glabrate, yellow-membranous for 1–2 mm. from the acute to obtuse tip (often tinged with red); corollas white (ochroleucous), 4–5 mm. long, the tube densely glandular to nearly glabrate, 1.8–2 mm. long, the throat campanulate 2–3 mm. long, with

lobes reflexed, 3–5 times as long as the lobes; achenes 5.5–6 mm. long, evenly pubescent with hairs 0.5–1.5 mm. long; pappus of 12–16 linear-oblong scales, 1.5–2 mm. long; anthers partially exserted, 3–3.5 mm. long; chromosome number not known.

Distribution.—Limestone soils, associated with pines and junipers at high elevations (5,500–10,000 ft.) on isolated mountain ranges of

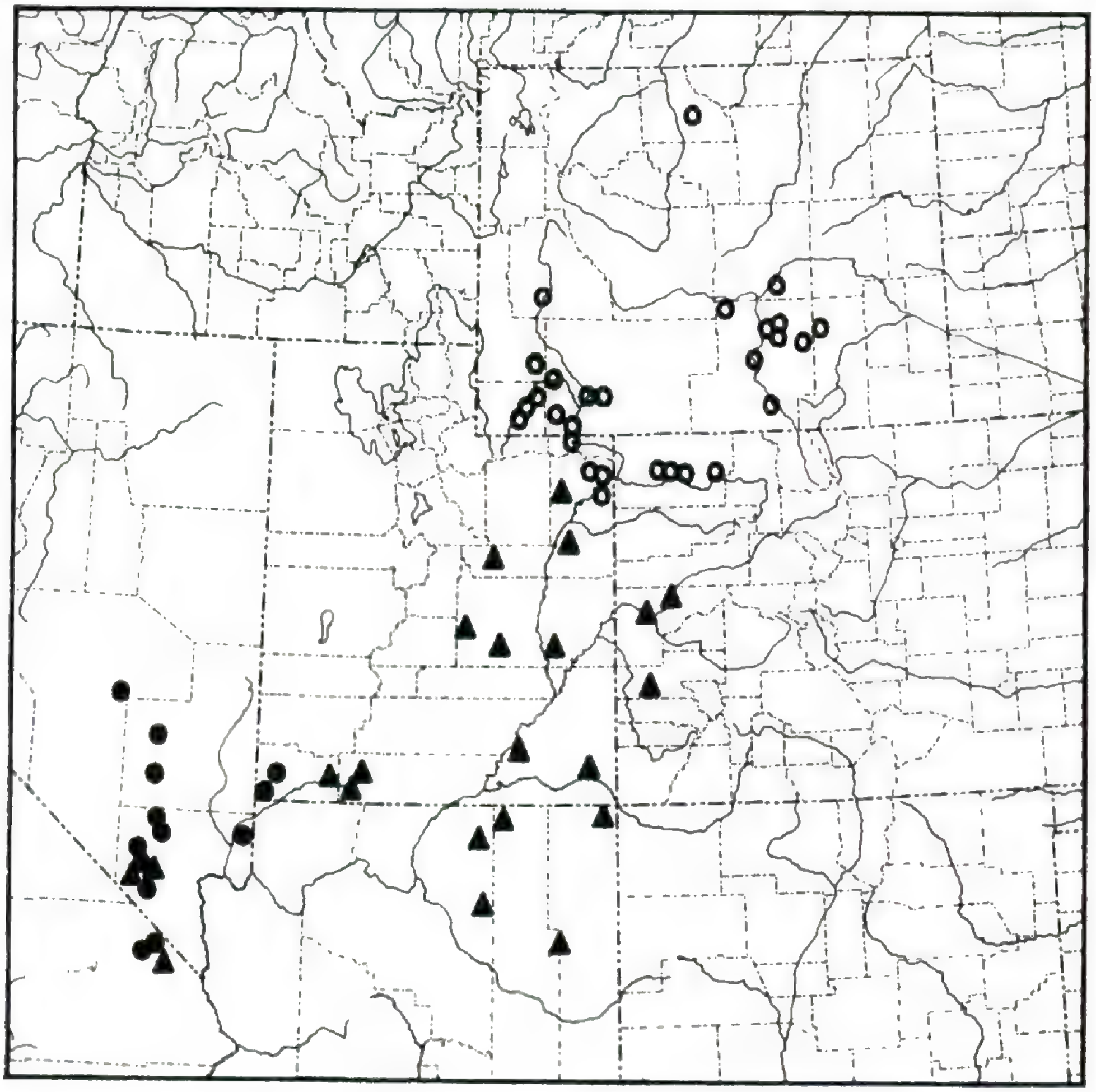


Fig. 36. Distribution of *Hymenopappus filifolius* var. *eriopodus* (disks), *H. f. megacephalus* (triangles), and *H. f. luteus* (circles).

southern Nevada, adjacent California (New York Mts.) and Washington Co., Utah (Fig. 36). Mid-May to mid-July.

*Hymenopappus filifolius* var. *eriopodus* is a very distinct variety in its typical habitat, but at lower elevations it intergrades completely with at least two yellow-flowered taxa of the *H. filifolius* group, var. *megacephalus* and var. *nanus*. Wilson's ranch in the Charleston Mts., Nevada, is outstanding in this

respect. At this locality var. *eriopodus* apparently extends down canyons to lower elevations where it comes in contact with var. *megacephalus*, a variety of the surrounding arid desert (1000-4500 ft.). Within this area of overlap clear $F_1$'s or their segregates have been collected (*Clokey 8651; Maguire 17992*), as well as both the putative parents.

The introgression of var. *eriopodus* with var. *nanus* is less conspicuous, but its effect may be seen by the more leafy stem and pale yellow flowers in the latter variety. This apparent intergradation is conspicuous in the Beaver Dam Mts., Utah, where their ranges overlap (*Preece & Turner 2558* cited under var. *nanus*).

*Hymenopappus filifolius* var. *eriopodus* has the vegetative aspect of var. *filifolius* of the Columbia Basin, with which it has frequently been confused. Var. *eriopodus* can be distinguished from var. *filifolius* by its white flowers, and larger size of pappus and throat.

REPRESENTATIVE SPECIMENS.—**California.** SAN BERNARDINO CO.: Clark Mt., 1 mi. S. of Coliseum Mine, *Wolf 7069* (DS, RSA, UC, WS). **Nevada.** CLARK CO.: Charleston Mts., Kyle Canyon, *Clokey 5618* (CAS, MO, NY, POM, RM, RSA, UC, US, WS). LINCOLN CO.: Deer Lodge, *Galway 8265* (US). NYE CO.: Nevada Nat'l. Forest, Cherry Cr. Pass, *Maguire & Holmgren 25610* (CAS, DS, GH, NY, UC, US, WS). **Utah.** WASHINGTON CO.: Diamond Valley, *Goodding 880* (GH, MO, NY, POM, RM, US).

### 3f. **Hymenopappus filifolius** var. **megacephalus,** var. nov.

Herbae perennes, caulibus plerumque tomentosis 1–6-foliatis, 30–60 cm. altis; foliis inferioribus bipinnatis 8–20(–30) cm. longis, segmentis 8–30 mm. longis, 1–2 mm. latis; involucris turbinatis campanulatisve, bracteis 8–12(–14) mm. longis; flosculis flavis 4–7 mm. longis, fauce 2–5 mm. longa; achaeniis 5–7 mm. longis; pappo conspicuo, squamellis 1.5–3 mm. longis.

Plants perennial, 30–70 cm. high, uniformly tomentose or (in the eastern part of its range) nearly glabrate; principal rosette leaves 8–20(–30) cm. long, bipinnately dissected with coarse, flattened, linear divisions, mostly 8–30 mm. long, 1–2 mm. wide; stem leaves 2–6, becoming reduced upwards; heads 3–14 per stem, subturbinate to campanulate, (20–)30–60-flowered, on ultimate peduncles 2–10 cm. long; principal involucral bracts 8–12(–14) mm. long, 2–5 mm. wide, loosely tomentose, yellow to reddish-membranous for 1–2 mm. from the acute to obtuse tip; corollas yellow (apparently pale-yellow in some specimens) 4–6(–7) mm. long, the tube glandular, 2–3 mm. long, the throat campanulate-tubular, 2–4(–5) mm. long with lobes reflexed, 3–6 times longer than the lobes; achenes 5–7

mm. long, pubescent with hairs 1–2 mm. long; pappus of 14–18 linear-oblong scales, 1–3 mm. long; anthers partially exserted, 3–4 mm. long; chromosome number not known. Type (pom); Nevada. Clark Co.: Las Vegas, 1000 ft., April 29, 1905, *M. E. Jones s.n.*, (pom, several sheets; ds, mo, us).

Distribution.—Sandy or gravelly soil in low desert areas of Clark Co., Nevada, adjacent California (Providence Mts.), eastern and southern Utah, adjacent northeastern Arizona, and western Colorado, 1000–5500 ft. (Fig. 36). May–November.

*Hymenopappus filifolius* var. *megacephalus* is a variety of peculiar distribution and wide variability. In Clark Co., Nevada, at lower elevations it is relatively constant in character, but at higher elevations of adjacent mountain ranges it intergrades with var. *eriopodus* (see discussion under that variety). In eastern Utah, western Colorado, and northern Arizona the taxon is quite variable, possibly as a result of long-time hybridization and multiple introgression with at least five other varieties of the *H. filifolius* complex which surround or overlap its periphery: var. *luteus* in the north; var. *cinereus* in the east; var. *pauciflorus* in the southeast; var. *lugens* in the south; and perhaps locally with var. *tomentosus* in Washington Co., Utah. (For further information see discussion under the appropriate varieties.) In spite of these infringements, the variety maintains a line of continuity which is characteristic over most of its range and for a large part of the material examined. In general the variety has fewer leaves and is less tomentose in the eastern portion of its range as contrasted with its appearance near the type area.

Var. *megacephalus* has apparently been responsible for much of the confusion existing in the *H. filifolius* complex of eastern Utah, northeastern Arizona, and western Colorado. Herbarium material of the variety from this region carried a hodge-podge of annotations: *H. lugens*, *cinereus*, *pauciflorus*, *tomentosus*, *eriopodus*, etc. In Colorado the name *H. ochroleucous* was given by Greene to a local (?) white flowered race of var. *cinereus* (as treated in this paper), which apparently has some of the characteristics of var. *megacephalus* (e.g., larger, coarser-pinnatifid leaves), but much more of the characteristics of var. *cinereus* proper. The type locality for Greene's species is near the eastern-most periphery of the range of var. *megacephalus*.

The possibility exists that the variety here typified includes only the individuals from Clark Co., Nevada, and vicinity, and that most of the remaining material to the east represents either a weakly defined separate variety or a common area of extensive hybridization and introgression among the several peripheral taxa mentioned above, such as that suggested by Gleason (1923) for *Vernonia illinoensis*. Gleason described this species from the Great Lakes region in 1906. Sixteen years later (1922), he decided that what he described as a species was, in reality, a hybrid complex of crosses and backcrosses resulting from the introgression of three species one into the other at a common area of overlap. Accordingly, he dropped the name. In the case of *H. filifolius* var. *megacephalus* the continuity of the combination of characters listed in the description and used in the key, combined with the correlation of supposed introgressant individuals with geographical overlap, argues against this latter hypothesis. In short, the peripheral variability is not random throughout the area of occupation, nor is it meaninglessly scattered. Further field study is needed to clarify the situation fully, but it is believed that the treatment used here is conservative as well as practical.

The variety is named for its large heads which are among the largest of the *Hymenopappus filifolius* complex, equaled or rivaled only by occasional specimens of the closely related var. *lugens*.

REPRESENTATIVE SPECIMENS.—**Arizona.** APACHE CO.: National Petrified Forest (Natural Bridge), *Osterhout 6855* (RM). COCONINO CO.: S. side of Painted Desert, *Osterhout 6962* (POM, RM). NAVAJO CO.: Betatakin, *J. T. Howell 24518 and 24519* (CAS). These last two cited specimens present good evidence for hybridization and introgression of var. *lugens* into var. *megacephalus*. **California.** SAN BERNARDINO CO.: Providence Mts., *Brandegee* (UC, US). **Colorado.** MESA CO.: DeBegue, *Osterhout 4281* (GH, RM). MONTROSE CO.: Naturita, *Payson 365* (GH, MO, RM, WS). **Nevada.** CLARK CO.: Las Vegas, *Goodding 2287* (GH, MO, RM). **Utah.** CARBON CO.: Price, June, 1898, *Stokes* (UC). EMERY CO.: 3.25 mi. N. of Emery, *M. E. Jones 5456d* (POM). GRAND CO.: Moab, June 9, 1913, *M. E. Jones* (NY, POM). KANE CO.: 1 mi. S. of Zion Junction, *Maguire 18888* (GH, NY, WS). SAN JUAN CO.: 3 mi. S. of White Mesa Dugway, *Holmgren & Hansen 3406* (GH, MO, NY, UC, US, WS). UINTAH CO.: Uinta Basin, 4 mi. w. of Willow Cr., E. slope of Big Pack Mts., *Rollins 1709* (GH, MO, NY, WS). WASHINGTON CO.: Zion Nat'l. Park, Summit of Lady Mts., *T. Craig 1433* (POM).

### 3g. **Hymenopappus filifolius** var. **lugens** (Greene) Jepson

*Hymenopappus lugens* Greene, Pittonia **4:** 43. 1899. *Hymenopappus filifolius* var. *lugens*, Jepson, Man. Fl. Pl. Calif. 1128. 1926. Lectotype chosen (US): California. San Bernardino Co.: "Bear Valley," San Bernardino Mts., on their eastern base, 6500 ft., June 24, 1894, *S. B. Parish 3113.* Greene did not designate a specific type, but based his name on two collections of Parish "whose earliest specimens were sent out as representing a variety of *H. luteus*, the later ones being labeled *H. filifolius.*" The collection cited above should serve as the type since it is a well-preserved specimen and is represented by isotypes in at least two other herbaria (MO, NY).

*Hymenopappus gloriosus* Heller, Bull. Torr. Bot. Club **26:** 551. 1899. Type examined (NY): Arizona. Coconino Co.: "Collected about Mormon Lake," 6000 ft., June 7, 1898, *Dr. D. T. MacDougal 71.*

*Hymenopappus scaposus* Rydb., Bull. Torr. Bot. Club **27:** 634. 1900. Type examined (NY): Arizona. Coconino Co.: "vicinity of Flagstaff," 7000 ft., June 18, 1898, *Dr. D. T. MacDougal 1229.*

*Hymenopappus macroglottis* Rydb., Bull. Torr. Bot. Club **27:** 636. 1900. Type examined (NY): Arizona, Coconino Co.: "Oak Creek, Aug. 5, 1883," *N. H. Rusby s.n.* The type does not have a collection number, but probable isotypes bear the collection number *692.*

*Hymenopappus nudatus* Wooton & Standley, Contrib. U. S. Nat. Herb. **16:** 191. 1913. Type examined (US): New Mexico. Grant Co.: Burro Mts., 5500 ft., June 6, 1903, *O. B. Metcalfe 107.*

Plants perennial, (20–)30–60 cm. high, densely grayish-tomentose to greenish-glabrate, except in the woolly basal leaf axils; rosette leaves (5–)6–14 cm. long, bipinnately dissected with flattened, linear ultimate segments, mostly 3–10 mm. long, 1–3 mm. wide, petiole composing ½–⅔ of the leaf; stem leaves 0–2(–3), much reduced; heads 3–8 per stem, campanulate, 20–72-flowered, on ultimate peduncles 2–12 cm. long; principal involucral bracts 6–10 mm. long, 3–4 mm. wide, gradate or in two or three main series, glabrous to densely tomentose, the apex conspicuously reddish to yellow-membranous for 1–2 mm. from the mostly obtuse to less often acute tip; corolla bright yellow or less often white, 4–6 mm. long, the tube sparsely glandular, 1.5–2 mm. long, the throat campanulate-tubular 2.2–3 mm. long, with lobes reflexed, (2.2–)4–8 times longer than the lobes; achenes 5–6 mm. long, pubescent with hairs 1–1.5(–2) mm. long; pappus of 16–18 linear-oblong scales, 1.2–2.5 mm. long; anthers partly exserted, 3–3.5 mm. long; $n = 17, 34$.

Distribution.—Mountain ranges of southern California and northern Baja California; northwestern to southeastern Arizona, adjacent southwestern New Mexico, Nevada (Virgin Mts.), and southwestern Utah, mostly at 5000–9000 ft., commonly associated with junipers, pines, or oaks in gravelly, rocky, clay, volcanic, schistose, and limestone soils (Fig. 37). May–September.

This is the most variable and perplexing variety of the *Hy-*

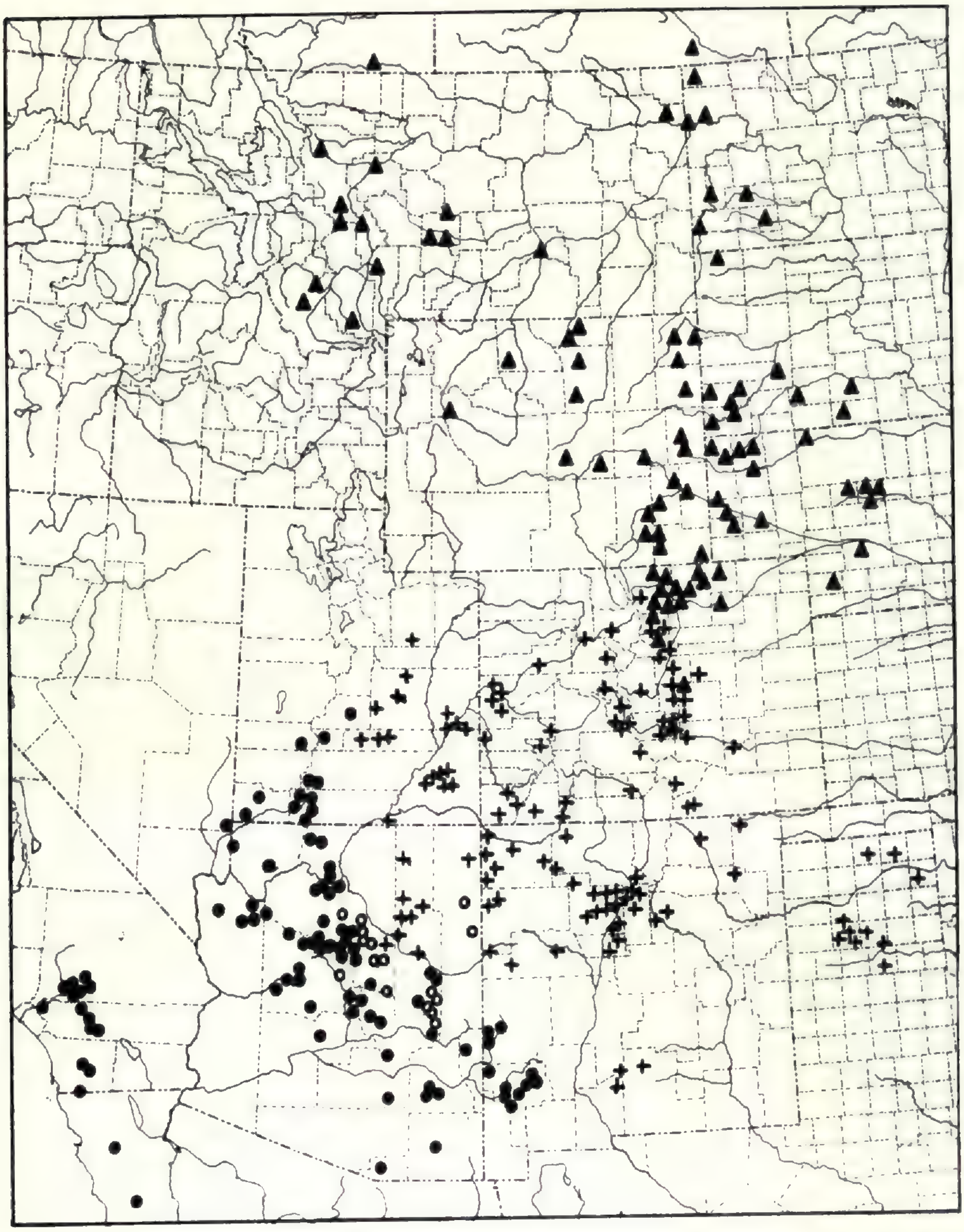


FIG. 37. Distribution of some varieties of *Hymenopappus filifolius*. *H. f. lugens*, yellow-flowered races (disks), white-flowered race (circles); *H. f. cinereus* (plus signs), and *H. f. polycephalus* (triangles).

*menopappus filifolius* complex. The treatment here accorded this variety is admittedly inadequate and future studies will undoubtedly show that the variety, as delimited in the present treatment, is composed of at least two, and possibly three, widespread races that are perhaps worthy of varietal rank. Though

aware of these races, the author has been unable to distinguish between them with any degree of certainty from herbarium material, and it seems probable that proper delimitation will have to await detailed field and chromosomal study. For this reason, and on practical grounds, the group has been treated as a well marked variety composed of several widespread and intergrading races.

In southern California and Baja California the variety is relatively constant in character. Almost without exception, specimens from this area have markedly gradate involucral bracts with red, almost crimson tips and edges; the florets are nearly always few in number (20–30); and the corolla throat is 5–8 times longer than the lobes.

The variety has its greatest complexity in northwestern Arizona (Mohave, Yavapai, and Coconino counties). In this region two, and possibly three, races of var. *lugens* occur: a yellow-flowered diploid race with essentially the same morphology as the California race, except that it has somewhat more florets to a head (20–40); a tetraploid yellow-flowered race with about the same morphology as the above, except that the bracts are not so gradate and are mostly without the red or crimson margins and the florets are more numerous (30–72); a white-flowered tetraploid race which has heads with 20–30 florets, the corollas with smaller throats, and which possesses smaller leaves than the above two races.

The diploid and tetraploid yellow-flowered races occur in the same general area (cf. *Preece & Turner 2610, 2614, 2618*). On herbarium sheets, as well as in the field, it is most difficult to distinguish between these groups, the characters mentioned above not being constant. When seed of both diploid and tetraploid plants were grown in a uniform garden, the tetraploids tended to be larger plants, with larger leaves (Fig. 29) and more numerous florets; diploid plants were smaller, with fewer florets. However, some of the tetraploid plants that were grown in the garden were not so well marked, being small and flowering late with fewer florets (perhaps due to injury during potting). Because of this strong resemblance between diploid and tetraploid races and because the tetraploid race regularly showed 1 to 3 quadrivalents at meiosis, it was suspected early in the

study of this group that the tetraploid arose by autoploidy from typical var. *lugens*. However, subsequent investigation revealed the presence of a close relative, var. *nanus* in this region, which apparently introgresses with the diploid race mentioned above. (Var. *nanus* normally lacks the red-tinged involucral bracts, and has more numerous florets with shorter throats than does the diploid form of var. *lugens*.) Thus it now seems more likely that the tetraploid is a segmental amphiploid as defined by Stebbins (1950). Typically, diploid var. *lugens* occurs in this area at higher elevations in pine woods, whereas tetraploid var. *lugens* seems to occur more often in the transition zone of pine woodland and juniper belts, or exclusively in the latter region.

The white-flowered race was not seen by the author west of Flagstaff in this area. It is possible that most, if not all, white-flowered var. *lugens* in Arizona is tetraploid. Unfortunately, most collectors have omitted flower color from their collection labels. The circles on the distribution dot map of var. *lugens* (Fig. 37) indicate those collections examined by the author that were obviously white-flowered (either the color was so indicated on collection labels, or the specimens were well enough preserved to determine this). Field observation indicates that these white-flowered plants are not just segregates in a population of primarily yellow-flowered individuals. In all instances the populations examined by the author were composed entirely of white-flowered individuals, though some populations were intermediate in this respect (i.e., all pale yellow). This white-flowered, tetraploid race loses most of its distinctiveness southeastward from Coconino Co., Arizona, to Grant Co., New Mexico, as it seems to grade into a densely tomentose,[9] yellow-flowered race with long throats (perhaps the same tetraploid race found in Mohave and Coconino counties).

Var. *lugens* intergrades to a small degree with var. *nudipes* and var. *tomentosus* in southwestern Utah, with var. *cinereus* and var. *megacephalus* in northeastern Arizona, and locally with var. *nanus* in Mohave Co., Arizona, and possibly in the Inyo Mts., California.

[9] The pubescence of these races is probably not a good character on which to distinguish them. Plants grown in the garden from seeds taken from specimens that were quite tomentose in the field appeared nearly glabrate.

In review, *Hymenopappus filifolius* var. *lugens* is a highly variable taxon of the southwestern United States which is composed of two or three closely related widespread races. These races are both diploid and tetraploid and their morphologies are probably complicated by introgression and intergradation from within and from without. In view of the complexities involved, it is believed that formal recognition should not be accorded these infraspecific units until detailed study justifies such action.

Representative specimens.—**Arizona.** apache co.: 3 mi. N. of Ft. Defiance, *Cutler 2135* (cas, mo, uc). cochise co.: 5 Mi. E. of Burro Mts., *Maguire 11570* (ny, us). coconino co.: Cape Royal, N. rim of Grand Canyon, *Goodman & Hitchcock 1639* (ds, mo, ny, rm, uc): 9 mi. E. of Peach Springs, *Preece & Turner 2610* (smu, ws); 2 mi. E. of Ashfork, *Preece & Turner 2618* (smu, ws); Meteor Crater rim (on boulder near entrance), 38 mi. E. S. E. of Flagstaff, *Preece & Turner 2667* (ws). gila co.: Globe, *Nelson 10341* (rm, uc). graham co.: 8 mi. up Swift Trail Rd., Pinaleno Mts., *B. & R. Maguire 11739* (gh, ny). greenlee co.: 27 mi. N. of Clifton, *Maguire 11073* (ny). mohave co.: Virgin Mts., pass above Whitney Ranch, *Munz 16783* (mo, pom, ws). navajo co.: 12 mi. N. of White River, White Mts., *Goodman & Hitchcock 1310* (cas, ds, gh, mo, ny, rm, uc). pinal co.: Oracle, Aug. 27, 1903, *M. E. Jones* (pom). santa cruz co.: 2 mi. N. of Vaughn, May 27, 1938, *J. F. Arnold* (cas, gh, us). yavapai co.: 5 mi. west of Seligman, *Preece & Turner 2614* (smu, ws). **California.** riverside co.: El Toro Mts., Coyote Canyon, *H. M. Hall 1178.1* (ds, uc, us). san bernardino co.: near Bear Valley, *Abrams 2899* (cas, gh, mo, ny, pom, uc, us): San Bernardino Mts., South Fork, upper Santa Ana Canyon, *Hall 7507* (ds, gh, mo, ny, pom, rm, uc, us). san diego co.: between Julian & Cuyamaca ("Gumbo Hill opposite Talley's"), July 16, 1906, *K. Brandegee* (gh, ny, pom, uc, us). **Nevada.** clark co.: "Mica Mines" (Mica Springs), *M. E. Jones 5072g* (us). **New Mexico.** catron co.: 35 mi. N. of Alma, highway 260, June 26, 1951, *Preece & Turner 2710* (smu, ws). grant co.: Silver City, *Eastwood 8402* (cas, gh, mo, us): Burro Mts., *O. B. Metcalfe 107* (gh, mo, ny, pom, rm, uc, us). **Utah.** beaver co.: 3 mi. E. of Beaver, May 30, 1913, *H. Redeker* (rm). garfield co.: 5 mi. S. of Panguitch, *Maguire 18710* (ny, ws). kane co.: 3 mi. W. of Long Valley Junction, *Preece & Turner 2466* (smu, ws). piute co.: Marysvale, *M. E. Jones 5355* (pom, us). sevier co.: near Richfield, *L. F. Ward 168* (gh, mo, us). washington co.: near St. George, *C. C. Parry 107* (gh, mo, ny).

Mexico. **Baja California.** Tantillas Mts., "just over boundary (in) Lower California," Sept. 9, 1875, *E. Palmer 183* (gh, mo, ny, uc, us).

### 3h. **Hymenopappus filifolius** var. **polycephalus** (Osterhout), comb. nov.

*Hymenopappus polycephalus* Osterhout, Torreya **18:** 90. 1918. Type examined (RM): "North of Livermore, Larimer Co., Colo., Aug. 11, 1917," *G. E. Osterhout 5680.*

Plants perennial, 30–60 cm. high, one to several crowns from a single, woody tap-root; stems slender, single from each crown, much-branched, densely tomentose to nearly glabrate, often with conspicuous sessile glands; principal rosette leaves sparsely tomentose to nearly glabrate, 6–15 cm. long, 4–6 cm. wide, bipinnately dissected into linear, almost filiform, glandular-punctate segments 8–30 mm. long and about 0.5 mm. wide; stem leaves 3–8, becoming reduced upwards; heads 5–50 per stalk (often more on late-flowering specimens), 20–50-flowered, on ultimate peduncles 2–8 cm. long; involucral bracts 5–8 mm. long, 2–4 mm. wide, yellow-membranous (very rarely red-tinged) for 1–2 mm. from the acute to obtuse tip; corollas yellow, 3–3.5 mm. long, the tube densely glandular, 1–1.8 mm. long, the throat campanulate, 1.3–1.8 mm. long with lobes reflexed, 2–3 times as long as the lobes; achenes 4–5 mm. long, densely pubescent with hairs 1–2 mm. long; pappus of 12–16 linear-oblong scales, 0.8–2 mm. (rarely less) long; anthers partially exserted, 2.5–2.8 mm. long; $n = 34$.

DISTRIBUTION.—Rolling, sandy plains and grasslands east of the Rocky Mountains from central Colorado to Canada (southern Alberta and Saskatchewan), extending on intermontane plains west to north-central Wyoming, western Montana, and east to western North Dakota, South Dakota, and Nebraska (Fig. 37). June–August.

The variety has the aspect of *H. tenuifolius*, especially when poorly collected specimens are dried and placed on herbarium sheets. In the field and on well preserved specimens, the variety can be distinguished at once from this species by the yellow flowers and perennial root. *H. tenuifolius* is a biennial with white flowers.

Osterhout proposed the specific name *polycephalus* in 1918, but it was not taken up by later workers. He apparently was very familiar with the plant in the field, and his numerous collections preserved at the Rocky Mountain Herbarium, with their annotated comments, indicate that he was dissatisfied with placing it either under *H. cinereus* Rydb. or *H. tenuifolius*. Nevertheless, Osterhout thought *polycephalus* was more closely aligned with *H. tenuifolius* since, in describing the species, he stated, "The close relationship of *Hymenopappus polycephalus*, however, is not with *H. cinereus* but with *H. tenuifolius* Pursh. It is as high and as leafy as *H. tenuifolius*, but the flowers are

yellow, not dull white, and it is a perennial, not a biennial." Johnson treated the entity as a questionable synonym of *H. cinereus* stating, "*Hymenoppapus polycephalus* is a puzzling form which suggests a perennial phase of *H. tenuifolius*."

In the present treatment, *polycephalus* has been treated as a variety of *H. filifolius* since its total characteristics indicate a much closer relationship to the members of this species. In spite of this closer affinity, var. *polycephalus* does have several characters which possibly link it to *H. tenuifolius;* indeed, there seems to be a considerable degree of intergradation between the two entities with respect to leaf dissection, amount of tomentum on the stem, and throat/lobe ratio.

It is interesting to note that var. *polycephalus*, so far as known, is tetraploid with $n = 34$, while both var. *cinereus* and *H. tenuifolius* are diploid with $n = 17$. Var. *polycephalus*, in Colorado, occupies a geographical position between these two taxa. From these facts it might be speculated that at some past time the Rocky Mountain var. *cinereus* came in contact with *H. tenuifolius* so that extensive hybridization occurred on the diploid level and concomitantly amphiploidy occurred. (Evidence of a once farther eastward extension of *H. filifolius* var. *cinereus* is found in the disjunct races of this variety in the panhandle region of Texas, a considerable distance from the normal range now occupied by the variety.) With recession of this peripheral contact at a later time, the amphiploids survived in the habitats in which they were produced and have since spread to the area they now occupy. In the few meiotic slides prepared of var. *polycephalus* pairing appeared normal, there being 34 bivalents. Unfortunately, seed of this variety was germinated too late in the study of this group to provide material for genetical experiments to test this hypothesis.

Representative specimens.—Canada. **Alberta.** Milk R., *Macoun 10937* (GH). **Saskatchewan.** Coteau de Missouri (Base of Coteau), *Macoun 98 (971)* (GH, NY, US).

United States. **Colorado.** BOULDER CO.: Lyons, *Fritchey 50* (MO). EL PASO CO.: edge of Black Forest, 15 mi. N. of Colorado Springs, *Goddard 961* (UC). JEFFERSON CO.: 1 mi. W. of Golden, *Beetle 2034* (GH, RM). LARIMER CO.: Fossil Cr., *Crandall 3202* (NY, RM, US, WS). MORGAN CO.: Narrows, opposite mouth of Bijou Cr., *Ward* (US). WELD CO.: near Keota, *Osterhout 6035* (RM, UC). **Montana.** BEAVERHEAD CO.: Bannock City, *S. Watson 220* (GH, US). BROADWATER CO.: 10 mi. S. E. of Helena, *Hitchcock & Muhlick 11782* (WS). CASCADE CO.: Great Falls, *Blankinship*

*721* (MO, POM, RM, US). GALLATIN CO.: St. Joe Cr., 1899, *W. W. Jones* (UC). LEWIS AND CLARK CO.: about 12 mi. N. W. of Silver City, July 2, 1948, *Hitchcock 17917* (RSA, UC, WS). MADISON CO.: about 10 mi. S. W. of Crockett Lake, Gravelly Range, *Hitchcock & Muhlick 12534* (WS). ROOSEVELT CO.: Culbertson, *E. L. Larsen 123* (MO). SILVER BOW CO.: Melrose, *Shear 5023* (NY, US). TETON CO.: Deep Cr. Canyon, Aug. 14, 1899, *Blankinship* (RM). WHEATLAND CO.: 20 mi. S. of Harlowton, *Hitchcock 16314* (RSA, WS). YELLOWSTONE CO.: Custer, June 10, 1890, *Blankinship 145* (MO, UC, US). **Nebraska.** BANNER CO.: Wild Cat Mts., July 16, 1891, *Rydberg* (NY, US). CHASE CO.: S. E. of Enders in Frenchman Valley, *Tolstead 411427* (UC). CHERRY CO.: Merriman, July 11, 1899, *J. M. Bates* (RM). DAWES CO.: Dunlap, June 16, 1939, *H. Hapeman* (MO). HOOKER CO.: Middle Loup R., near Mullen, *Rydberg 1554* (US). LINCOLN CO.: (w/o locality) *Barker 2600* (MO). MORRILL CO.: Broadwater, June 11, 1935, *H. Hapeman* (MO, NY). SCOTTS BLUFF CO.: N. of Mitchell, *Osterhout 7208* (RM). SIOUX CO.: Rocky outcrops, *J. Kramer 7* (DS, MO). THOMAS CO.: Halsey, June 26, 1912, *R. J. Pool & D. Folsom* (MO). **North Dakota.** DIVIDE CO.: Alkabo, *E. L. Larsen 95* (GH, MO). BILLINGS CO.: Medora, *Bolley 402* (NY, RM). HETTINGER CO.: Mott, *O. A. Stevens 143* (UC, US). SLOPE CO.: Marmarth, *L. R. Moyer 480* (NY). STARK CO.: Dickinson, *O. A. Stevens 713* (MO, UC, US). WILLIAMS CO.: Williston, *W. B. Bell 246* (RM, UC). **South Dakota.** CUSTER CO.: Fairburn, *Hayward 1498* (RM). FALL RIVER CO.: 3 mi. S. of Hot Springs, *P. Johnson 229* (GH, NY). HARDING CO.: Table Mt., Cave Hills, *Visher 408* (RM). PENNINGTON CO.: near Wall, *E. J. Palmer 37252* (GH). TODD CO.: Rose Bud Cr., *E. J. Wallace 102* (NY). WASHABAUGH CO.: Bear Cr., *Visher 2085* (NY). **Wyoming.** ALBANY CO.: Sybille Hills (Cr.), *A. Nelson 328* (GH, MO, NY, RM, US). BIG HORN CO.: Otto, Aug., 1878, *N. Edwards* (NY). CONVERSE CO.: E. of Douglas, *C. L. Turner 92* (RM). CROOK CO.: Ewing, *S. Seig 7* (RM). FREMONT CO.: 13 mi. S. of Dubois, *Porter & Rollins 5773* (RM). GOSHEN CO.: Ft. Laramie, *A. Nelson 8310* (GH, MO, NY, POM, RM, US). JOHNSON CO.: near Kaycee, *A. & R. Nelson 1101* (GH, MO, NY, RM, UC, US, WS). LARAMIE CO.: Table Mt., *A. Nelson 1369* (RM). NATRONA CO.: Bates Cr., *L. N. Goodding 199* (DS, POM, RM, UC). NIOBRARA CO.: Lusk, *F. H. Knowlton 106* (US). PLATTE CO.: Guernsey Lake St. Park, *C. L. Porter 4000* (GH, RM, SMU, UC). SHERIDAN CO.: E. of Sheridan, *S. S. Sharp 156* (RM). WESTON CO.: near Newcastle, *Degener & Peiler 16235* (MO, NY).

3i. **Hymenopappus filifolius** var. **tomentosus** (Rydb.), comb. nov.

*Hymenopappus tomentosus* Rydb. Bull. Torr. Bot. Club **27:** 633. 1900. Type examined (NY): Utah. "St. George," 1877, *Dr. E. Palmer 270.*

*Hymenopappus niveus* Rydb. N. Am. Flora **34:** 52. 1914. Type examined (NY): Utah. "Springdale," 4000 feet, May 14, 1894, *M. E. Jones 5261.*

Plants perennial, 30–70 cm. high, permanently densely white tomentose; larger rosette leaves 6–10 cm. long, 2–3 cm. wide, bipinnately parted with many short, filiform divisions 3–6 mm. long; stem leaves 5–12, not much

reduced; heads 4–14 per stem, subturbinate to campanulate, 30–40-flowered, on ultimate peduncles 1–6 cm. long; principal involucral bracts 7–10 mm. long, 2–3 mm. wide, densely tomentose, yellow-membranous for 1–2 mm. from the acute tip (rarely red-tinged); corollas yellow, 3–4.5 mm. long, the tube densely glandular, 1.5–2 mm. long, the throat 1.5–2 mm. long with lobes reflexed, 3–4(–6) times longer than the lobes; achenes 4.5–5 mm. long, evenly pubescent with hairs 0.5–1 mm. long; pappus of 14–16 linear oblong scales 0.8–1.8 mm. long; anthers partially exserted, 2.5–3 mm. long; $n = 17$.

Distribution.—Sandy soil on rocky limestone hills and mesa tops, 3500–7000 ft.; known only from collections in Washington and western Kane counties, Utah (Fig. 28). May–June.

*Hymenopappus filifolius* var. *tomentosus* occupies a position seemingly at the center of the *H. filifolius* complex as concerns maximum variability and total number of taxa present.

In spite of its restricted range, the variety, as viewed from herbarium and field observation, shows evidence of intergradation or introgression with at least three taxa of the *H. filifolius* complex: var. *pauciflorus*, var. *megacephalus*, and var. *lugens*. These varieties are kept separate for the most part by ecological and/or geographic barriers: var. *lugens* occurs at somewhat higher elevations on gravelly or sandy-clay soils; var. *megacephalus* occurs at lower elevations on sandy soils; var. *pauciflorus* occurs toward the southwestern periphery of the range of *tomentosus* on deep sandy soils. In this latter area almost complete intergradation between the two taxa is found.

At one locality in Kane Co. (1 mi. S. of Glendale, *Preece & Turner 2503*) a few specimens, apparently intermediate between var. *tomentosus* and var. *lugens*, were found growing in what otherwise appeared to be a "pure" colony of this latter variety. These few intermediates were still in bud so that they lagged at least 1–2 weeks behind the others which were in full bloom. The intermediates collected were of good size (apparently 2–3 years plus in age). Ten plants grown in a uniform garden from seed of var. *lugens* from this locality maintained the characteristics of that variety, and no evidence of contamination from var. *tomentosus* was found. Seed (or open flowers) from the intermediates could not be obtained. Extensive intergradation of characters between varieties *lugens* and *tomentosus* apparently does not occur, though the varieties are probably fully compatible. Further field and genetical studies of the *Hymenopappus filifolius* complex in this area will undoubtedly

yield much information as to isolation mechanisms within several, spatially overlapping, closely related infraspecific taxa.

Variety *tomentosus* has the flower size and shape of var. *megacephalus*, but the vegetative characteristics are those of var. *pauciflorus*. Its rather complete intergradation with these two taxa to the southeast and southwest makes the hypothesis that var. *tomentosus* had its origin from an early time of more extensive overlap and introgression attractive, although it is probable that the situation is much more complex than that visualized.

*Hymenopappus niveus* Rydb. is a name based upon specimens which show some evidence of introgression from var. *megacephalus* (e.g., leaves somewhat more coarsely pinnatifid); otherwise it is typical of the variety *tomentosus* as here delimited.

REPRESENTATIVE SPECIMENS.—**Utah.** KANE CO.: 1 mi. S. of Glendale, highway 89, *Preece & Turner 2503* (WS). WASHINGTON CO.: near Canaan Ranch, *M. E. Jones 5262C* (MO, POM, UC): St. George, 1877, *E. Palmer 270* (GH, MO, NY, UC).

### 3j. **Hymenopappus filifolius** Hook. var. **filifolius**

*Hymenopappus filifolius* Hook. Fl. Bor. Am. **1:** 317. 1833. Probable isotype and fragment of type examined (GH): "on the undulating grounds of the Columbia, near the Wallawallah" *Douglas* (quoted from information given in the original description).

*Hymenopappus tenuifolius* Dougl. (non Pursh) in Fl. Bor. Am. **1:** 317. 1833, as synonym.

*Hymenopappus columbianus* Rydb. N. Amer. Fl. **34:** 52. 1914. Type examined (US): Washington. "near Moses Lake, Douglas Co." (now Grant Co.), 390 meters, July 4, 1893, *J. H. Sandberg & J. B. Leiberg 375*.

Plants perennial, 30–100 cm. tall, densely white tomentose to nearly glabrate; principal rosette leaves 10–20 cm. long, bipinnately dissected with long filiform divisions, 10–50 mm. long, 0.5–1.5 mm. wide; stem leaves (0–)2–5, becoming reduced upward; heads (2–)6–40 per stem, campanulate, (15–)20–45-flowered, on ultimate peduncles 1–15 cm. long; principal involucral bracts 6–10 mm. long, 3–4 mm. wide, densely tomentose to nearly glabrate, yellow-membranous for 1–2 mm. from the acute to obtuse tip; corollas yellow, 2.5–4.5 mm. long, the tube densely glandular, 1.2–2 mm. long, the throat 1.6–2.5 mm. long, 3–5 times longer than the lobes, with lobes reflexed; achenes 4.5–6 mm. long, evenly pubescent with short hairs, 0.4–1 mm. long; pappus of 16–22 linear-oblong scales, 0.2–1 mm. long; anthers partially exserted, 2.5–3 mm. long; $n = 17$.

DISTRIBUTION.—Sand dunes and gravelly, sandy soils of the Columbia Basin of Washington and barren sandy-clay or clay soils of adjacent Oregon (John Day Valley, south to Harney Co., Fig. 28). May–September.

*Hymenopappus columbianus* Rydb. is a leafy, densely tomentose form

of the variety. This is the common aspect of the plant in Washington; southward into Oregon both tomentose and glabrate forms occur, as well as leafy and non-leafy types. In the southern part of its range the taxon picks up characters of var. *nanus*, a variety of the Great Basin. However, var. *filifolius* is held together by a combination of characters, the most constant being the small pappus and shortly pubescent achene.

Variety *filifolius* closely resembles var. *polycephalus* of the northern Great Plains, with which it has been confused in nearly all manuals. Variety *polycephalus* is a tetraploid with smaller throats to the corollas, less wool in the leaf axils, and shorter peduncles.

Representative specimens.—**Oregon.** crook co.: sandy, sterile hills on the Burns-Prineville road, *Cusick 2631* (GH, MO, NY, POM, RM, UC, US). gilliam co.: hills S. of Arlington, *Henderson 14472.* (UC). grant co.: Squaw Cr., Humphrey's Ranch, John Day Valley, *Henderson 5236* (CAS, DS, GH, MO, RM, US). harney co.: lower Willow Cr. Canyon, *Peck 18990* (UC). morrow co.: Paterson Ferry, *Eastwood & Howell 3517* (CAS). wasco co.: Muddy or Muddy Station (Muddy Ranch?), John Day Valley, May 12, 1885, *T. Howell 447* (GH, NY, US, WS). wheeler co.: 5 mi. N. of Mitchell, *Peck 10081* (NY, WS). **Washington.** adams co.: 12 mi. W. N. W. of Washtucna, *Turner 2293* (SMU, WS). benton co.: 5 mi. N. W. of Richland, *L. S. Rose 48154* (CAS, RSA, US). franklin co.: 8 mi. N. of Kahlotus, *Constance & McMurray 1139* (GH, MO, US). grant co.: near Moses Lake, *Sandberg & Leiberg 375* (CAS, GH, MO, NY, POM, RM, UC, US, WS). walla walla co.: near Walla Walla, *Brandegee 903* (GH, UC). yakima co.: 3 mi. W. of Mabton, highway 3A, June 15, 1950, *R. E. Fye 29* (WS).

### 3k. **Hymenopappus filifolius** var. **nanus** (Rydb.), comb. nov.

*Hymenopappus nanus* Rydb. N. Amer. Fl. **34:** 53. 1914. Type examined (NY): Nevada. Elko Co.: "ridge above Cave Creek Post Office," East Humboldt or Ruby Mts., 9300 ft., Aug. 20, 1908, *A. A. Heller 9494.*

Plants perennial, 5–50 cm. high, evenly sparsely tomentose throughout or less so on the peduncles; principal rosette leaves 2–12 cm. long, 1–4 cm. wide, bipinnately dissected with linear, nearly filiform, ultimate divisions 5–15 mm. long, 0.5–1.0(–1.5) mm. wide, the secondary divisions few in number, the petiole comprising ½–⅔ of the leaf; stem leaves 0–2(3), much reduced; heads 1–5(–6) per stem, 30–60-flowered, mostly on long slender peduncles 3–15 cm. long; principal involucral bracts 6–9 mm. long, 2–5 mm. wide, tomentose to nearly glabrate, yellow-membranous (often reddish-tinged) for 1–2 mm. from the acute to broadly ovate tip; corollas light yellow, 3–4 mm. long, the tube moderately glandular, 1.5–2 mm. long, the throat campanulate, 1.5–2 mm. long with lobes reflexed, 2–4 times longer than the lobes; achenes 4.5–5.5 mm. long, pubescent with hairs 0.2–1(–2) mm. long; pappus of 14–18 linear oblong scales, (1–)1.5–3 mm. long; anthers partly exserted, 2.5–3 mm. long; $n = 17$.

Distribution.—Mountain ranges and foothills of the Great Basin, mostly in coarse limestone soils of juniper belts or at higher elevations

on rocky limestone and shaley outcrops, 4800–9800 ft., eastern California (Inyo Mts.) central and eastern Nevada to western Utah and Mohave Co., Arizona (Fig. 28). May–July.

Rydberg assigned the specific name *nanus* to this variety because of its small habit. In the original description he stated, "stems 1 dm., rarely 1.5 dm. high," which is correct for the few specimens he examined; however, isotypic material (MO) shows specimens up to 20 cm. high. An attempt was made to distinguish a group of specimens that would "fit" Rydberg's description. Two groups of plants were sorted out of herbarium material: plants of smaller habit, smaller leaves and fewer heads, and plants of the opposite nature, otherwise essentially alike. When the completed distribution dot-maps were compared there was almost complete overlap of ranges. In addition, complete intergradation of habit, leaf size, and head number was encountered. In short, the variety appears to have a wide ecologic amplitude: where it grows at higher altitudes on rocky outcrops there is a tendency to dwarfness; in more favorable habitats there is a tendency toward robustness.

Variety *nanus* shows some of the characteristics of the typical var. *lugens* in the Inyo Mts., California (*Hovanitz s.n.*), the bracts, in particular, appearing much like this latter variety. The collections from Mohave Co., Arizona (cited below) appear to be established races that apparently have hybridized with var. *lugens*, since they show certain characteristics of that variety. Seed of var. *nanus* collected near Peach Springs (*Preece & Turner 2608*) were grown in a uniform garden along with collections of var. *lugens* from the same general region (*P. & T. 2610*).[10] The contrast between these taxa was maintained (cf., Table 1). In addition, it was noted that the race of var. *nanus* did not produce flowers after mid-August, while var. *lugens* continued to produce flowers until frost set in (late September). A tabulation of the flowering dates of var. *nanus* taken from 37 herbarium sheets representing different collections was made and the following data obtained:[11]

[10] Ten plants were grown of each of these varieties.

[11] The method used in assigning the dates in this chart was as follows: The letter E was given to those specimens in early flower, M for those in mid-flower, and L for those in late flower. After this initial tabulation the L's and E's were moved back and up one week respectively, to approximate more closely equivalent flowering conditions.

| Month | Week | Specimens in flower | Month | Week | Specimens in flower |
|---|---|---|---|---|---|
| May | 1 | 1 | July | 1 | 5 |
| | 2 | 0 | | 2 | 2 |
| | 3 | 1 | | 3 | 1 |
| | 4 | 2 | | 4 | 0 |
| June | 1 | 9 | | | |
| | 2 | 1 | August | | 0 |
| | 3 | 11 | | | |
| | 4 | 4 | September | 1 | 1 |

In addition to that with var. *lugens*, var. *nanus* apparently shows some intergradation with var. *eriopodus* at mid-elevations in the mountainous regions, where their ranges overlap (*Preece & Turner 2558*).

The variety probably has its closest relationships with var. *lugens* and var. *idahoensis*. It can be distinguished from the former variety by its lighter yellow, more numerous florets with shorter throats, more linear, filiform leaf segments, and less crimson-tinged bracts. It may be distinguished from var. *idahoensis*, along with other characters, by its narrower, more pubescent leaf segments, and larger pappus scales.

Representative specimens.—**Arizona.** Mohave co.: Hackberry, *M. E. Jones 4556* (cas, ds, ny, pom, rm, uc, us); 6 mi. E. of Peach Springs, *Preece & Turner 2608* (smu, ws). **California.** Inyo co.: Chris's Cabin Flat, Inyo Mts., *Alexander & Kellogg 2536* (gh, mo, uc). **Nevada.** Elko co.: Ruby Mts., ridge above Cave Creek Post Office, *Heller 9494* (mo, ny, uc, us). Esmeralda co.: 2 mi. W. of Lida, Silver Peak Range, *Maguire & Holmgren 25616* (cas, ds, gh, mo, ny, uc, us, ws). Eureka co.: Monitor Valley, S. of Lone Mt., June 12, 1944, *Ripley & Barneby 6221* (cas). Lincoln co.: Pioche, Aug. 31, 1912, *M. E. Jones* (pom). Nye co.: near Sunnyside, *Ripley & Barneby 4007* (cas). White Pine co.: 30 mi. S. of Ely, *Maguire & Holmgren 25627* (cas, ds, gh, ny, uc, us, ws). **Utah.** Beaver co.: Half-way station W. of Wa Wa, June 26, 1906, *M. E. Jones* (pom). Iron co.: 0.5 mi. S. E. of Cedar City, *Degener 16618* (mo, us). Juab co.: Fish Springs, June 4, 1891, *M. E. Jones* (pom). Millard co.: 37 mi. from Delta, *Maguire & Becraft 2864* (gh, uc). Sevier co.: "Vermilion," W. side of valley, June 4, 1901, *M. E. Jones* (pom). Tooele co.: Dugway, June 2, 1891, *M. E. Jones* (mo, uc, us). Washington co.: 7 mi. S. W. of Shivwits, Beaver Dam Mts., *Preece & Turner 2558* (smu, ws).

(*To be continued*)

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## ASA GRAY AND ANDREW JACKSON DOWNING: A BIBLIOGRAPHICAL NOTE


A. Hunter Dupree


Although he labored for thirty years as director of Harvard's Botanic Garden, Asa Gray published little on horticulture, and his work in botany completely overshadowed the garden side of his career. An early publication,[1] however, which does not appear in the standard list of Gray's published works,[2] connects him both with horticulture and with Andrew Jackson Downing, its most important devotee in the pre-Civil War United States. In 1841, Wiley and Putnam of New York published, under the editorship of Downing and Gray, the first American edition of John Lindley, *The Theory of Horticulture*.

Since Gray was in New York in 1841 he doubtless knew the young landscape gardener who lived on the Hudson River. And since the firm of Wiley and Putnam was the publisher both of Gray's *Botanical Textbook* and Downing's *Treatise on the Theory and Practice of Landscape Gardening*, the origin of the collaboration is easy to visualize. Each editor signed the notes he added. Downing usually discussed practical problems of gardening in the United States, while Gray supplied data on American climate and also comments concerning plant physiology in terms similar to the 1842 edition of the *Botanical Textbook*, on which he was working at the time.

[1] John Lindley, *The Theory of Horticulture: or, an Attempt to Explain the Principal Operation of Gardening upon Physiological Principles* (First American edition, with notes, etc., by A. J. Downing and A. Gray, N. Y., 1841).

[2] [Sereno Watson and G. L. Goodale], "List of the Writings of Dr. Asa Gray, Chronologically Arranged, with an Index," *American Journal of Science*, 3rd ser., XXXVI (1888), Appendix, 3–67.

The appearance of this American edition of the British botanist Lindley's work on horticulture illustrates two important tendencies in plant science in the United States about the year 1840. In the first place, it was a part of the campaign waged by Gray and John Torrey to bring American botany abreast of current European theory.[3] In the second place, the book is a part of the first great effort to apply science to American agriculture and horticulture. The translation of Justus Liebig's epochal work on agricultural chemistry appeared in the United States in the same year of 1841.[4] Gray explicitly recognized the importance of Liebig's work in a footnote to Lindley's chapter on soil and manure, where he said, "These remarks were perfectly applicable when this work was published (early in 1840); but the treatise on *Organic Chemistry in its application to Agriculture and Physiology*, by the distinguished Professor Liebig, which appeared a few months later, has greatly elucidated the whole subject."[5] The immediate popularity of Liebig's work perhaps accounts for the obscurity into which the American edition of Lindley soon fell.

That Gray and Andrew Jackson Downing worked together as young men has a certain importance to the later history of horticulture and landscape gardening in the United States. Their collaboration seems to have ceased when Gray moved to Cambridge in 1842, but Downing in the next few years laid the basis for a brilliant and pioneering career in landscape architecture. He had just begun to lay out the Smithsonian Institution grounds in Washington when he died in 1852 at the age of thirty-seven while rescuing victims of a steamboat disaster on the Hudson.[6] His influence nevertheless lived on and was definitely present in the planning of the Arnold Arboretum, established in 1872.

Back in 1841 Downing had personally presented a copy of his *Treatise on the Theory and Practice of Landscape Gardening* to Asa Gray.[7] In 1859, after Downing's death, his neighbor and

[3] The better known example is John Lindley, *A Natural System of Botany* (First American edition, with an appendix by John Torrey, N. Y., 1831).

[4] See *Liebig and After Liebig: A Century of Progress in Agricultural Chemistry* (Washington, 1942).

[5] Lindley, *Theory of Horticulture* (American edition), 314 n.

[6] Herbert A. Kellar, "Andrew Jackson Downing," *Dictionary of American Biography*, V, 417–418.

[7] Presentation copy in Gray Herbarium Library.

follower, Henry Winthrop Sargent, brought out a sixth edition of the same work with a supplement describing Wodenethe, his own estate on the Hudson, and also the estate of this relative, Horatio Hollis Hunnewell, of Wellesley, Massachusetts.[8]

It was Henry W. Sargent who first kindled the interest of both Hunnewell and his younger relative, Charles Sprague Sargent, in horticulture and landscape gardening.[9] Thus of the men who played major roles in the institutional rearrangements of Harvard in 1872 out of which the Arnold Arboretum grew, three—Gray, Hunnewell, and C. S. Sargent—had long acquaintance with the tradition stemming from the work of Downing. Frederick Law Olmsted, an old friend of Gray's and the co-worker with C. S. Sargent in laying out the Arnold Arboretum, also owed much to the influence of Downing. Hence the founders of the Arboretum in the 1870's had the benefit of a horticultural tradition, of which they were a part, going back thirty years to New York state and Andrew Jackson Downing, and the collaboration of the two co-editors of the American edition of Lindley's *Theory of Horticulature* bore fruit after many seasons.—University of California, Berkeley.

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# ADDITIONS TO THE FLORA OF ST. PAUL ISLAND, NOVA SCOTIA

J. S. Erskine

St. Paul Island is the northernmost point of Nova Scotia, a cliffbound island three and one-quarter miles long by never more than one mile wide. The vascular flora was first listed by Dr. A. H. MacKay in 1883. Then in 1929 Miss L. M. Perry and Dr. Muriel Roscoe spent a month on the island and collected exhaustively the vascular plants and the algae, lists of which appeared in *Rhodora* in May, 1931. The present author spent from August 10th to 17th on the island, collecting plants for the Nova Scotia Museum of Science. Miss Perry's lists and floristic descriptions are still valid today, although

[8] See C. S. Sargent, "Henry Winthrop Sargent," L. H. Bailey, ed., *Standard Cyclopedia of Horticulture* (N. Y., 1915), III, 1594.

[9] E. W. Sargent and C. S. Sargent, eds., *Epes Sargent of Gloucester and his Descendants* (Boston, 1923), 193.

many of her plant-names have been changed and some varieties discarded. As all these alterations can be traced through Gray's *Manual of Botany*, 8th Edition, I have not thought it worthy of space to comment upon them and I offer this list merely as a supplement to hers. When new varietal refinements have seemed of interest, I have included them in my list. The vascular collections have been checked completely by D. S. Erskine in the N. S. Museum, and in part by others, and I have accepted their determinations when their judgement has disagreed with mine. The chief differences between Miss Perry's list and mine, apart from the fluctuating element of introduced and often impermanent weeds, suggest that she combed the bare headlands more thoroughly, I the woods and bogs. Her list showed 280 species and 17 still accepted varieties, mine 290 species and 6 varieties, the combined total being 320 species thus far known for the island.

### Additions to Miss Perry's List

1. *Lycopodium complanatum* L., var. *flabelliforme* Fern. One station, Atlantic Cove by path to Big Lake.
2. *Picea mariana* (Mill.) BSP. Many stunted trees in bogs.
3. *Potamogeton confervoides* Reichenb. Sterile in Little Lake.
4. *Festuca elatior* L. Scarce weed by road to Southwest.
5. *Poa annua* L. Clumps around barn, Southwest.
6. *Poa palustris* L. Headland, Southwest.
7. *Agropyron repens* (L.) Beauv., var. *subulatum* (Schreb.) Reichenb., f. *Vaillantianum* (Wulf. & Schreb.) Fern. Garden, Atlantic Cove.
8. *Agropyron trachycaulum* (Link.) Malte, var. *novae-angliae* (Scribn.) Fern. Headlands, Atlantic Cove & Petrie's Point.
9. *Hordeum jubatum* L. Salty hilltop, Northeast.
10. *Elymus mollis* Trin. Headland, Martin Power's Cove.
11. *Agrostis scabra* Willd. Roadside to Southwest.
12. *Agrostis tenuis* Sibth. Wood-edge, Atlantic Cove.
13. *Hierochloe odorata* (L.) Wahl. Boggy slope, Trinity Cove.
14. *Eleocharis halophila* Fern. Brackish pool on NE Head.
15. *Eleocharis Smallii* Britt. Edge of Little Lake. Probably Miss Perry's *E. palustris* was this alone and not 14.
16. *Eriophorum spissum* Fern. Occasional in bog, Petrie's Pond.
17. *Carex cephalantha* (Bailey) Bickn. Swamp by path to Northeast.
18. *Carex leptalea* Wahl. Wood near Little Lake.
19. *Carex novae-angliae* Schwein. Wood, Atlantic Cove.
20. *Carex salina* Wahl. (× *C. paleacea* Wahl. ?DSE)
21. *Carex pallescens* L., var. *neo-gaea* Fern. Petrie's Pond.

22. *Carex oligosperma* Mx. Frequent in high bogs, Coggin's Mtn.
23. *Juncus pelocarpus* Mey. Floating in bog-pool, SW Head.
24. *Smilacina trifolia* (L.) Desf. Frequent in bog-holes.
25. *Habenaria Hookeri* Torr. Wood, Atlantic Cove.
26. *Habenaria blephariglottis* (Willd.) Torr. Common on high bogs, Coggin's Mtn.
27. *Goodyera repens* (L.) R. Br., var. *ophioides* Fern. In woods, Norwegian Mtn., Coggin's Mtn., SW Head.
28. *Salix Bebbiana* Sarg. Three sterile shrubs from scattered stations.
29. *Myrica Gale* L. Common around bog-holes.
30. *Betula lutea* Mx. f. Rare shrubs with unusual leaves.
31. *Betula papyrifera* Marsh., var. *commutata* (Regel) Fern. and var. *macrostachya* Fern. The species was reported by Miss Perry. These varieties are recognizable among a jumble of variants.
32. *Betula borealis* Spach. In alder scrub by path to NE and on high bogs, Coggin's Mtn.
33. *Betula pumila* L., var. *renifolia* Fern. Found by Miss Perry and later segregated to this variety.
34. *Rumex domesticus* Hartm. Hen-run, Atlantic Cove.
35. *Cerastium arvense* L., var. *viscidulum* Gremli. Found by Miss Perry and now segregated into this variety.
36. *Neslia paniculata* (L.) Desv. Hen-run, Atlantic Cove.
37. *Drosera intermedia* Hayne. Common around edge of bog-holes.
38. *Pyrus americana* Marsh. Miss Perry found only *P. decora*, but my collections were nearer to *P. americana*.
39. *Prunus virginiana* L. Occasional in wood, Atlantic Cove; forming scrubby woods west of Big Lake.
40. *Vicia Cracca* L. Rare weed, Atlantic Cove.
41. *Hypericum perforatum* L. Beside road to Southwest.
42. *Oenothera biennis* L. Spreading weed, Atlantic Cove.
43. *Sanicula marilandica* L. Wood west of Big Lake.
44. *Coelopleurum lucidum* (L.) Fern. Headland, Martin Power's Cove.
45. *Cornus* × *unalaschkensis* Ledeb. Reported but not collected by Miss Perry. Fairly frequent.
46. *Cornus alternifolia* L. f. Wood near Little Lake.
47. *Monotropa Hypopitys* L. One patch on Coggin's Mtn.
48. *Bartonia paniculata* (Mx.) Muhl., var. *sabulonensis* St. J. & Fern. Not uncommon in bog, Petrie's Pond & Coggin's Mtn.
49. *Lappula echinata* Gilib. By barn, Southwest.
50. *Achillea Millefolium* L. was found by Miss Perry, but my specimens have been corrected to *A. lanulosa* Nutt.
51. *Matricaria maritima* L. By barn, Southwest.
52. *Sonchus arvensis* L. Headland, Northeast.
53. *Sonchus asper* (L.) Hill. Roadside to Southwest.
54. *Lactuca biennis* (Moench.) Fern. Occasional in east woods.
55. *Hieracium aurantiacum* L. One plant, Atlantic Cove.
56. *Hieracium canadense* Mx. Established by road to Southwest.

The bryophytes of St. Paul Island have not previously been listed. The island, with its woods, bogs and raw headlands, is a better habitat for mosses than for vascular plants, yet only one species of moss to six of vascular plants was collected as compared to one to four on the mainland. This list, therefore, cannot claim to be exhaustive. The more difficult mosses and hepatics were checked by Dr. A. L. Andrews of Ithaca, N. Y., the sphagna by Dr. H. L. Blomquist of Duke University, and my thanks are due to both of them. Twenty species of lichens were collected also, but, as these have not been checked by an authority and as they do not differ appreciably from those of the Cape Breton barrens, the names are not listed here.

### Hepatics

*Barbilophozia barbata* (Schmid.) Loeske. 2417, Atlantic Cove.
*Bazzania trilobata* (L.) S. F. Gray. 2411, Woods, Little Lake.
*Blasia pusilla* L. 2360, 2436. SW Head, Norwegian Mtn.
*Blepharostoma trichophyllum* (L.) Dum. 2375, path to NE.
*Calypogeia Neesiana* (M. & C.) K. Mull. 2415, Atlantic Cove.
*Calypogeia Trichomanis* (L.) Corda. 2360, Southwest Head.
*Cephalozia bicuspidata* (L.) Dum. 2436, Norwegian Mtn.
*Cephalozia connivens* (Dicks.) Lindb. 2436, Norwegian Mtn.
*Cephalozia leucantha* Spruce. 2436, Norwegian Mtn.
*Cephaloziella hampeana* (Nees) Schiffn. 2438, Path to NE.
*Harpanthus scutatus* (Web. & Mohr) Spruce. 2460, Southwest Head.
*Lepidozia reptans* (L.) Dum. 2416, Atlantic Cove.
*Lophozia grandiretis* (Kaal) Schiffn. Southwest Head.
*Scapania irrigua* (Nees) Dumort. 2418, 2459, SW Head, Atlantic Cove.

### Mosses

*Aulacomnium palustre* (Web. & Mohr) Schwaegr. 2368, South Shore.
*Amblystegium compactum* (C. Müll.) Aust. 2420, woods, SW Head.
*Atrichum undulatum* (Hedw.) Beauv. 2427, Norwegian Mtn.
*Brachythecium salebrosum* (Web. & Mohr) Bry. Eur. 2372, 2379, swampy woods, South Shore.
*Bryum pallens* (Web. & Mohr) Brid. 2380, wet rocks, path to NE.
*Ceratodon purpureus* (Hedw.) Brid. 2351, 2358, 2400, 2425. Outcrops, Norwegian Mtn., SW Head, Atlantic Cove.
*Dicranella heteromalla* (Hedw.) Schimp. Humus in wood, SW Head.
*Dicranella subulata* (Hedw.) Schimp. 2394, path to NE.
*Dicranum Bergeri* Blan. 2398, 2450. Atlantic Cove, Coggin's Mtn.
*Dicranum Bonjeani* DeNot. Humus in wood, SW Head.
*Dicranum Drummondii* C. Müll. 2354, 2379, 2445. Humus in wood, Norwegian Mtn.; SW Shore; slope by Petrie's Pond.
*Dicranum scoparium* Hedw. 2392, 2408, 2413, 2420, 2448. Woods, Path to NE, Little Lake, Trinity Cove, Coggin's Mtn.

*Drepanocladus fluitans* (Hedw.) Warnst. 2422, 2426. Bog, SW Head, Norwegian Mtn.
*Drepanocladus revolvens* (Sw.) Warnst. 2378, Bog by path to NE.
*Fontinalis novae-angliae* Sull. 2406, in Little Lake.
*Grimmia maritima* Turn. 2431, rocks, Trinity Cove.
*Hylocomium splendens* Hedw. 2412, rare, woods by Little Lake.
*Hypnum pallescens* (Hedw.) Bry. Eur. 2353, tree bole, Norwegian Mtn.
*Leptodictyum riparium* (Hedw.) Warnst. 2390, bog-pool, SW Head.
*Mnium hornum* Hedw. 2364, 2370, 2356. Rocks, SW Head.
*Mnium punctatum* Hedw. 2414, 2451. Atlantic Cove, Coggin's Mtn.
*Pohlia nutans* (Hedw.) Lindb. 2377, 2397, 2444. Common.
*Plagiothecium striatellum* (Brid.) Lindb. 2383, Rock talus, SW Head.
*Pleurozium Schreberi* (Brid.) Mitt. 2407, by Little Lake, rare.
*Polytrichum gracile* Smith. 2409, woods by Little Lake, rare.
*Polytrichum juniperiunm* Hedw. 2388, 2446, Bog, SW; path, NE.
*Rhytidiadelphus squarrosus* (Hedw.) Warnst. 2387, 2410, Little Lake, SW Head.
*Sphagnum capillaceum* (Weiss.) Schrank., var. *tenellum* (Schimp.) Andrews. 2447, Coggin's Mtn.
*Sphagnum centrale* C. Jens. 2424, Big Lake. det. A. L. Andrews.
*Sphagnum compactum* DC. 2366, SW Head.
*Sphagnum cuspidatum* Ehrh. 2391, SW Head.
*Sphagnum fimbriatum* Wils. 2369, boggy SW shore.
*Sphagnum fuscum* (Schimp.) H. Klingr. 2395, 2449. Bogs.
*Sphagnum Girgensohnii* Russ. 2374, wet woods, South Shore.
*Sphagnum imbricatum* Hornsch. 2384, SW Head.
*Sphagnum Lindbergii* Schimp. 2381, Big Lake.
*Sphagnum magellanicum* Brid. 2428, Norwegian Mtn.
*Sphagnum papillosum* Lindb. 2365, SW Head.
*Sphagnum recurvum* Beauv. 2419, 2429. Atlantic Cove; Norwegian Mtn.
*Sphagnum riparium* Angst. 2389, SW Head.
*Sphagnum squarrosum* Crome. Wood, SW Head.
*Sphagnum tenellum* Pers. 2386, SW Head.
*Sphagnum Warnstorfii* Russ. 2396, bog by path to NE.
*Tetraphis pellucida* Hedw. 2435, Norwegian Mtn.
*Ulota crispa* (Hedw.) Brid. 2352, tree-trunk, Norwegian Mtn.
*Ulota phyllantha* Brid. 2434, Norwegian Mtn.

Of these only two are new Nova Scotian records. *Sphagnum riparium* Angst. is to be expected here but has not hitherto been reported. *Sphagnum centrale* C. Jens. has not usually been found near the coasts but is otherwise within its expected range. Dr. Andrews said that this specimen lacked the usual robustness of this species.

I have to give grateful acknowledgement of assistance to the Nova Scotia Museum of Science for financing the expedition, to Dr. Andrews and Dr. Blomquist for determinations, and to Miss Perry for having provided an excellent list to build on.—Wolfville, Nova Scotia.

# A CYTOTAXONOMIC STUDY OF THE GENUS HYMENOPAPPUS (COMPOSITAE)

Billie L. Turner

(*Continued from page 242*)

31. **Hymenopappus filifolius** var. **idahoensis,** var. nov.

Herbae perennes, caulibus 0–2-foliatis 10–45 cm. altis; foliis inferioribus bipinnatis sparse tomentosis glabratisve, 6–15 cm. longis, 3–5 cm. latis, segmentis remotis 8–20 mm. longis, 1–2 mm. latis; inflorescentiis 4–14 capitulatis; flosculis flavis 3.2–4.5 mm. longis, fauce 1.5–2 mm. longa; pappo 0.7–1.3 mm. longo.

Plants perennial, 15–45 cm. high, mostly glabrate to sparsely tomentose, except in the axils of the rosette leaves which are densely woolly; principal rosette leaves 6–15 cm. long, 3–5 cm. wide, glabrous to sparsely tomentose, sparsely bipinnately dissected with relatively broad, flattened, linear divisions, mostly 8–30 mm. long, 1–2 mm. wide; stem leaves 0–2, much reduced; heads 4–14 per stem, campanulate, 25–70 flowered (rarely less), on nearly glabrate ultimate peduncles 1–6 cm. long; principal involucral bracts 7–9 mm. long, 3–4 mm. wide, mostly glabrate, or nearly so, yellow-membranous (very rarely reddish) for 1–2 mm. from the acute tip; corollas bright yellow, 3.2–4.5 mm. long, the tube moderately glandular, 1.5–2.5 mm. long, the throat campanulate, 1.5–2 mm. long with lobes reflexed, 3–4 times as long as the lobes; achenes 4.5–6 mm. long, pubescent with hairs about 1 mm. long; pappus of 12–16 linear oblong scales, 0.6–1.3 mm. long; anthers partly exserted, 2.5–3 mm. long; $n = 17$. Type (ws): Idaho. Lemhi Co.: Junction of Warm Spring Cr. and Salmon R. (about 14 mi. S. of Salmon); rusty-red, sandy-silty hill slopes, June 12, 1951, *S. J. Preece & B. L. Turner 2378* (Isotypes to be distributed).

Distribution.—Known only from Idaho along the Salmon and Big Lost Rivers in Custer and Lemhi counties where it occurs on low rocky, gravelly, or sandy foothills (Fig. 28). June–July.

*Hymenopappus filifolius* var. *idahoensis* is a poorly defined variety that has been segregated primarily on its geographical isolation and secondarily on its combination of rather minute differences (cf. Table 1, p. 218). The variety would probably be considered no more than a race of var. *nanus* were it included in the range of that taxon; however, it may be distinguished from that variety by being less pubescent throughout, having more numerous heads on shorter peduncles, shorter pappus, and longer, more flattened, thicker ultimate leaf segments.

At the type locality, specimens of var. *idahoensis* that superficially resemble var. *nanus* (smaller, more pubescent plants, with fewer heads) may be found growing on rocky hilltops.

The character of the pappus is seemingly constant, however, and the degree of resemblance is merely an approach.

REPRESENTATIVE SPECIMENS.—**Idaho.** CUSTER CO.: Below Clayton, *R. J. Davis 486* (DS, WS); 10 mi. N. E. of Clayton, *Hitchcock 15668* (RSA, UC, WS); low hills across river from Challis, *Hitchcock & Muhlick 8958* (CAS, GH, MO, RM, SMU, WS); Challis Cr., *Macbride & Payson 3338* (CAS, GH, MO, NY, POM, RM, UC, US); Mackay, *Nelson & Macbride 1561* (DS, GH, MO, RM). LEMHI CO.: about 15 mi. S. of Salmon, *Hitchcock, Rethke & van Raadshooven 3726* (CAS, DS, GH, UC, WS); Junction of Box Cr. and Salmon R., 16 mi. S. of Salmon, *Preece & Turner 2387* (SMU, WS).

### 3m. **Hymenopappus filifolius** var. **cinereus** (Rydb.) Johnston

*Hymenopappus cinereus* Rydb. Bull. Torr. Bot. Club **27:** 634. 1900. *Hymenopappus filifolius* var. *cinereus* Johnston, Contrib. Gray Herb. **68:** 98. 1923. Type examined (NY): Colorado. Walsenberg, 1800 m., June 5, 1900, *P. A. Rydberg & F. K. Vreeland 5479.*

*Hymenopappus arenosus* Heller, Bull. Torr. Bot. Club **25:** 200. 1898. Isotypes examined: New Mexico. Santa Fe Co.: near Espanola, 5600 ft., May 17, 1897, *A. A. & E. G. Heller 3542.*

*Hymenopappus ochroleucus* Greene, Plantae Bakerianae **3:** 30. 1901. Isotypes examined: Colorado, Cimarron, 6900 ft., June 28, 1901, *C. F. Baker 269.* In the original description Greene cited only the following specimens, "C. F. Baker, 25 and 269." Material of collection number *269* is widely distributed in herbaria and should serve as the type, instead of collection number *25* which was not found in the specimens examined by the author.

Plants perennial, 15–40 cm. high, sparsely grayish-green tomentose; principal rosette leaves 5–14 cm. long, bipinnately dissected with linear, filiform divisions, 0.5–1 mm. wide, conspicuously impressed-punctate; stem leaves (0–)2–4, much reduced upwards; heads 1–6 per stem, subturbinate to campanulate, 25–40 flowered, on ultimate peduncles 1–6 cm. long; principal involucral bracts 6–9 mm. long, 2–4 mm. wide, glabrous to densely tomentose, yellow or rarely white-membranous for 1–2(–3) mm. from the acute to obtuse tip; corolla yellow or rarely white (ochroleucous), 3–4.5 mm. long, the tube moderately glandular, 1.5–2.5 mm. long, the throat campanulate 1.5–2.5 mm. long with lobes reflexed, 2.5–4 times longer than the lobes, achenes 4–6 mm. long, evenly pubescent with conspicuous hairs 1–3 mm. long; pappus of 14–18 linear oblong scales, 1.5–2 mm. long; anthers partially exserted 2–3 mm. long; $n = 17$.

DISTRIBUTION.—Rocky Mountains, in exposed situations at mid-elevations (5,500–10,000 ft.), Colorado, eastern Utah, central and northern New Mexico, and northeastern Arizona, with outliers in the rocky, limestone canyons of the northern panhandle of Texas, and in White Sands National Monument, New Mexico (Fig. 37). May–September.

*Hymenopappus filifolius* var. *cinereus* is a relatively widespread, variable taxon the races of which occur on several soil types at various eleva-

tions: White Sands National Monument (gypsum); Espanola, New Mexico (deep sand); Cimarron, Colorado (gravelly-clay); Boulder, Colorado (black shale), etc.

The name *Hymenopappus ochroleucus* Greene is based on a white-flowered race of var. *cinereus* (as treated in this paper) which shows evidence of apparent introgression or gene-flow from var. *megacephalus*, a variety found only a short distance to the west from this locality (Cimarron, Colo.). A white-flowered race is also known in var. *lugens* of the filifolius complex, but that is a tetraploid, differing in several characters from the present race, which is diploid.

In the mountainous regions of northern New Mexico, var. *cinereus* appears to have two distinct altitudinal races: a leafy-stemmed ecotype at lower elevations occurring principally in deep sand (*Heller 3542; Preece & Turner 2739, 2741*), and a scapose ecotype at somewhat higher elevations occurring in rocky or shallow, sandy-clay soils (*Heller 3555*). No sharp breaks or lines can be drawn between these populations and attempts to recognize these groups on herbarium sheets has not met with success. At present it seems best to consider them only local races of a highly variable taxon.

Specimens from the rather isolated panhandle region of Texas can be distinguished from the mass of the material of var. *cinereus* by several characters, such as its more subscapose habit, longer filiform leaf segments, and apparently white flowers. It seems best, in view of our present knowledge, to consider these Texas plants no more than relict races of a once more widespread *cinereus* complex, noting, however, that further study may justify the elevation of these races to varietal rank.

*Hymenopappus filifolius* var. *cinereus* grades into var. *luteus* in Moffat Co., Colorado, into var. *megacephalus* in the western part of its range (*E. H. Graham 8321*), and into var. *lugens* and var. *pauciflorus* in the southwestern part of its range (northeastern Arizona and southeastern Utah). Locally in Colorado it intergrades with var. *parvulus* (see discussion under that variety).

*Hymenopappus arenosus* Heller is the earliest name for this taxon; however, Johnston, in making the varietal combination,

chose Rydberg's species (he gave no reason) and consequently *cinereus* is now the earliest varietal name and must be used, according to the International Code of Botanical Nomenclature (1952).

REPRESENTATIVE SPECIMENS.—**Arizona.** APACHE CO.: Luka-Chukai Mts., S. of View Point, *Goodman & Payson 2881* (GH, MO, NY, UC). COCONINO CO.: between Winslow and Flagstaff, *McKelvey 4505* (GH, POM). NAVAJO CO.: Mishongnovi, Hopi Ind. Res., *R. A. Darrow* (CAS, NY). **Colorado.** ALAMOSA CO.: Alamosa, *F. Ramaley 12006* (RM). ARCHULETA CO.: Arboles, *C. F. Baker 688* (GH, MO, NY, POM, RM). BOULDER CO.: 7 mi. N. of Boulder, *Preece & Turner 2848* (SMU, WS). CHAFFEE CO.: 4 mi. W. of Salida, *Preece & Turner 2830* (SMU, WS). DELTA CO.: Eckert, *Osterhout 6124* (RM). DENVER CO.: Inspiration Point, *Clokey 3951* (CAS, GH, MO, NY, POM, RM, UC, US, WS). DOUGLAS CO.: Gann, June 23, 1920, *Osterhout & Clokey 3952* (CAS, GH, MO, POM, RM, UC, US, WS). EAGLE CO.: Deep Creek, *Killip 36451* (US). ELBERT CO.: 2 mi. N. E. of Fondis, *M. Ownbey 1282* (GH, MO, NY, RM, UC, WS). EL PASO CO.: Colorado Springs, June 25, 1879, *M. E. Jones s.n. (809)* (DS, NY, POM, RM, US). FREMONT CO.: Penrose, *A. Nelson 10544* (GH, MO, NY, RM, UC). GARFIELD CO.: Rifle, *Osterhout 2128* (NY, RM). GRAND CO.: 6.5 mi. E. of Kremmling, *Turner 2948* (WS). HUERFANO CO.: La Veta, *Osterhout 6700* (MO, POM, RM). JEFFERSON CO.: Morrison, *Osterhout & Clokey 3096* (CAS, GH, RM, UC, US). LAKE CO.: Twin Lakes, 1896, *F. Clements 386* (NY). LA PLATA CO.: Durango, *Baker, Earle & Tracy 1028* (GH, MO, NY, POM, UC, US). LARIMER CO.: W. of Loveland, *Osterhout 256* (NY, RM). LAS ANIMAS CO.: Brantly Canyon, *Osterhout 2044* (GH, RM). MESA CO.: Grand Junction, *Osterhout 6552* (POM, RM). This group of specimens presents good evidence that *H. filifolius* var. *megacephalus* hybridizes or introgresses into var. *cinereus* in this region; near coal mines, Grand Junction, June 15, 1900 (1901) *S. G. Stokes* (NY, UC, US). MONTEZUMA CO.: Mancos, *Crandall 3205* (NY, RM). MONTROSE CO.: Cimarron, *C. F. Baker 269* (DS, GH, MO, NY, POM, RM, UC, US, WS). OTERO CO.: Rocky Ford, July, 1894, *G. E. Osterhout* (RM). OURAY CO.: Dallas, *Preece & Turner 2788* (SMU, WS). PARK CO.: 2 mi. W. of Glentivar, *Beetle 224* (NY, RM). PUEBLO CO.: Walsenburg, *Rydberg & Vreeland 5479* (NY, RM). SAGUACHE CO.: Crestone, *F. Ramaley 12083* (RM). **New Mexico.** BERNALILLO CO.: 2 mi. E. of Albuquerque, *Krammerer 44* (MO, NY, US). COLFAX CO.: between Cimarron and Raton, *McKelvey 2430* (GH, POM). DONA ANA CO.: White Sands, *Wooton 167* (DS, MO, NY, POM, RM, UC, US). HARDING CO.: about 20 mi. N. of Mosquero, *Eggleston 20177* (NY, US). MCKINLEY CO.: Gallup, *Eastwood 5617* (CAS). OTERO CO.: Round Mt., along Tularosa Cr., *Wooton* (US). RIO ARRIBA CO.: near Lybrooks, *Mathias 617* (MO). SANDOVAL CO.: 2 mi. N. of Jemez Springs, *Preece & Turner 2746* (SMU, WS). SAN JUAN CO.: near Huerfano Peak, *M. E. Mathias 630* (MO). SAN MIGUEL CO.: near Pecos, *Standley 5059* (MO). SANTA FE CO.: hills at Santa Fe, 7300 ft., *A. A. & E. G. Heller 3555* (DS, GH, MO, NY,

POM, US, WS). UNION CO.: Emery Gap, N. M. to Branson, Colo., *Eggleston 20154* (NY, US). VALENCIA CO.: 7 mi. N. of Trechado, *Cutler 2092* (CAS, GH, MO, UC). **Texas.** ARMSTRONG CO.: 3 mi. S. W. of Palodura, *Cory 13477* (GH). BRISCOE CO.: chalk hill, edge of caprock about 5 mi. W. of Quitaque, highway 85, *E. Whitehouse 10021* (SMU). HANSFORD CO.: 5 mi. S. E. of Gruver, *Shinners 8232* (GH, RM, SMU, UC, WS). HEMPHILL CO.: 5 mi. S. of Canadian, *Shinners 8290* (SMU). OCHILTREE CO.: 8 mi. S. S. E. of Perryton on steep rocky bluffs only, *Shinners 8264* (SMU). POTTER CO.: Amarillo Cr., *Reverchon 3326* (MO, SMU). RANDALL CO.: Palo Duro Canyon, Sept. 2, 1907 *C. R. Bell 1229* (US). **Utah.** EMERY CO.: Calf Springs Canyon, 8 mi. from road, San Rafael Swell, *B. & R. M. Maguire 18313* (GH, NY, US, WS). GRAND CO.: Grand River Canyon, below Moab, *Rydberg & Garrett 8495* (NY, RM). SAN JUAN CO.: between Blanding and Kigalia Ranger Station, *Holmgren & Hansen 3484* (GH, NY, UC, US). WAYNE CO.: Thurber, *M. E. Jones 5709C* (POM, US).

### 4. **Hymenopappus mexicanus** Gray

*Hymenopappus mexicanus* Gray, Proc. Am. Acad. **19:** 29. 1883. *Rothia mexicana* O. Ktze. Rev. Gen. **1:** 361. 1891. Type examined (GH): Mexico. San Luis Potosi. "In montibus frigid[is] prope San Miguel," Sept. 1876, *Dr. J. G. Schaffner 348.*

*Hymenopappus integer* Greene, Pittonia **3:** 249. 1897. Isotypes examined: Mogollon Mts., (dry hills), Sept., 1881, *H. H. Rusby 179 (180).*

*Hymenopappus obtusifolius* Heller, Bull. Torr. Bot. Club **26:** 551. 1899. Type examined (NY): Arizona. Coconino Co.: "vicinity of Flagstaff," 7000 ft., July 5, 1898, *Dr. D. T. MacDougal 240.* A more specific locality was given in the original description by Heller as "Fort Valley, west of San Francisco mountains."

*Hymenopappus petaloideus* Rydb. N. Amer. Fl. **34:** 54. 1914. Type examined (NY): Arizona. Cochise Co.: "Head of Rock Creek Canyon," Chiricahua Mts., 8000 ft., Oct. 6, 1907, *J. C. Blumer 2215.*

Plants perennial, 20–90 cm. high, stems slender, erect, unbranched, greenish-glabrate to densely white-tomentose; leaves alternate, forming a basal rosette, absent or becoming reduced up the stem, simple to once-pinnate, up to 20 cm. long and 2.5 cm. wide, nearly glabrous to densely tomentose, obscurely impressed-punctate, lobes (when present) broad, ovate to broadly lance linear, 1–7 mm. wide; heads several to numerous, discoid, 20–40-flowered, in flattish cymose panicles, on slender or short-thickened peduncles 0.5–10 cm. long; involucre campanulate, principal bracts 9 to 11, nearly glabrate to densely tomentose, 7–9 mm. long, yellowish to white-membranous for 1–5 mm. from the acute to obtuse tip (rarely reddish-tinged); corollas yellow, 3–4.5 mm. long, the tube densely glandular, 2–2.5 mm. long, the throat campanulate, 1–2.5 mm. long, 3–4 times as long as the lobes; achenes obpyramidal, 4-sided, 4–6 mm. long, glabrous to sparsely puberulent (especially when immature), achene faces 2–3-nerved, rarely somewhat rugose; pappus of 12 to 20

short, obtuse to spatulate-laciniate scales, 0.4 mm. long to nearly obsolete; anthers partially exserted (rarely completely so) about 2.3 mm. long; $n = 17$.

Distribution.—Open areas in igneous soils of yellow pine, spruce and aspen woods, central and southeastern Arizona, southwestern New Mexico, and south into the Sierra Madre Mts., states of Chihuahua, and San Luis Potosí, Mexico (Fig. 25). Late June–October.

*Hymenopappus mexicanus* is a very distinct species throughout its range, but it shows a great deal of variability, especially in leaf shape. *H. integer* Greene is based on a series of specimens with mostly entire leaves; however, in the field, as well as on a wide selection of herbarium material, there is no constancy in this character, populations as well as individual specimens having leaves that range from completely simple to once-pinnate.

*Hymenopappus petaloideus* Rydberg is a form of the species from the Chiricahua Mts., Arizona, which has more conspicuous, acute, membranous-tipped involucral bracts. This character is not peculiar to this region but occurs repeatedly throughout most of the range of the species, being quite variable even within the same general area (e.g., Mogollon Mts., New Mexico). However, material from or near the type locality of *H. mexicanus* (San Luis Potosí, Mexico) does tend to have consistently broader, more obtuse involucral bracts, this seemingly correlated with a more glandular corolla. The scarcity of material from central Mexico makes it difficult to weigh the constancy or variability of these characters in this region.

*Hymenopappus mexicanus*, in so far as is known, does not hybridize or intergrade with other species of the genus although one such member (*H. filifolius* var. *lugens*) was observed growing close to this species in parts of Coconino Co., Arizona. Both *H. filifolius* var. *lugens* and *H. mexicanus* occur in pine woods, but the latter species tends to occur at somewhat higher elevations, rarely, if ever, extending downslope to the juniper zone.

*Hymenopappus mexicanus* apparently represents a reduced line that has evolved more or less separately from the main mass of the aboriginal stock that has produced the genus as it exists today. In leaf aspect it resembles *H. artemisiaefolius* and *H. scabiosaeus;* however, in its perennial habit and floral characters it approaches *H. radiatus* (disregarding the rays). In total characters *H. mexicanus* is closer to this latter species,

but this does not mean that its ancestry can be traced through it.

Representative specimens.—**Arizona.** Apache co.: White Mts., Black R., Thompson's Ranch, *Goodding 598* (cas, gh, ny, rm, us). Cochise co.: Chiricahua Mts., head of Rock Cr. Canyon, *Blumer 2215* (gh, ny, uc). Coconino co.: Flagstaff, *M. E. Jones 3955* (cas, ds, gh, ny, pom, rm, uc, us). Gila co.: Natanes plateau, *Goodding 1094* (ny, us). Navajo co.: Lakeside, *G. J. Harrison 5481* (us). Pima co.: Rincon Mts., *Neally 88* (ny, us). Yavapai co.: Copper Basin, *Toumey 713* (us). **New Mexico.** Catron co.: Mogollon Mts., on Mogollon Cr., *Metcalfe, 316* (ds, gh, mo, ny, pom, rm, uc, us). Grant co.: vicinity of Silver City, G. O. S. Ranch, *M. E. Jones 28612* (ds, mo, uc). Sierra co.: Mimbres Mts., top of Hillsboro Peak, *Diehl 432* (pom).

Mexico. **Chihuahua.** Near Colonia Garcia, *Townsend & Barber 137* (gh, mo, ny, pom, rm, uc, us). **San Luis Potosí.** Pelote, *Purpus 4722* (mo, uc); Minas de San Rafael, *Purpus 4772a* (gh, ny, uc).

Series Biennes

### 5. **Hymenopappus biennis** sp. nov.

Herbae biennes e radicibus simplicibus obconicis; caulibus foliatis ramosis erectis solitariis; foliis inferioribus sparse tomentosis bipinnatis 6–16 cm. longis, segmentis remotis anguste linearibus 6–20 mm. longis, 1–3 mm. latis; inflorescentiis laxe cymoso-paniculatis 20–60 capitulatis; capitulis radiatis, radiorum floribus 1-seriatis pistillis fertilibus, discorum hermaphroditis; involucris campanulatis, bracteis 5–8 mm. longis, 3–5 mm. latis, 2–3-seriatis; radiorum corollis ligulatis albidis 14–16 mm. longis, 6–8 mm. latis, disci flavis 3–3.5 mm. longis, tubo 1.5 mm. longo, fauce campanulata, lobis aequalibus triangularibus; achaeniis glabratis quadrangularibus 4 mm. longis; pappo obscuro.

Plants biennial, 60–100 cm. tall; stems single from each tap-root, much-branched and leafy, tomentose to nearly glabrate, pithy at the center or often hollow; basal rosette leaves 6–16 cm. long, 3–6 cm. wide, bipinnately dissected into linear, mostly flattened, ultimate segments 6–20 mm. long, 1–3 mm. wide, sparsely tomentose to nearly glabrate, conspicuously impressed-punctate; stem leaves 10–40, gradually reduced upward; heads 20–40 per stem, campanulate, 40–60-flowered, on ultimate peduncles 1–6 cm. long, inflorescence a large, much-branched, cymose panicle; receptacle dome-shaped, without chaff; principal involucral bracts 5–8 mm. long, 3–5 mm. wide, sparsely tomentose to nearly glabrate, yellow-membranous for 1–2 mm. from the acute to obtuse tip; ray flowers 8, pistillate and fertile, tubular at the base for about 2 mm., extending into a conspicuous white ligule 14–16 mm. long, 6–8 mm. wide, not cleft at the apex or obscurely so; disk flowers yellow, 3–3.5 mm. long, the tube densely glandular 1.5 mm. long, the throat campanulate 1.5–2 mm. long with lobes reflexed, 2–3 times longer than the acute lobes; achenes black, glabrous (or with a few sessile glands near the apex),

4 mm. long, obpyramidal, 4-sided, becoming incurved near the periphery of the head; pappus obsolete or nearly so (0–0.2 mm. long); anthers partially exserted, 2.5 mm. long; chromosome number not known. TYPE consisting of 2 sheets (GH): Texas. Culberson Co.: Guadalupe Mts., "wooded rocky ridge above McKittrick Canyon, 2300 m.," July 17, 1931, *J. A. Moore & J. A. Steyermark 3484* (Isotypes CAS, DS, MO, NY, UC).

DISTRIBUTION.—Principally in limestone soils in pine woods and protected canyons of central and south-central New Mexico (Sandia, Oscuro, and Sacramento Mts.), extending into the Guadalupe Mts. of Trans-Pecos Texas, 7,000–10,000 ft. (Fig. 24). July–October.

*Hymenopappus biennis* is a distinct species the total morphological relationships of which are undoubtedly with *H. newberryi* and *H. radiatus*. It differs from both these species, however, in several fundamental characters. *Hymenopappus biennis* is a tall, leafy biennial, whereas *H. newberryi* and *H. radiatus* are smaller, subscapose perennials. Since all three of these radiate taxa are perfectly distinct, being separated by morphological and geographical discontinuities which, insofar as is known, are not bridged, they are treated here as species.

The discovery of *H. biennis* has made possible a better understanding of the evolutionary trends which seem to have taken place within the genus *Hymenopappus*. It appears to be the "missing link" which ties a part of the biennial complex back to the perennial groups. Indeed, with rays, *H. flavomarginatus* would be a near perfect match for *H. biennis*. It is likely that *H. biennis* is an early off-shoot of the line that gave rise to the perennial radiate species. Thus, one might assume that the major evolutionary lines within the genus were established at a relatively early time, each of these lines retaining certain primitive characters of the supposed common progenitor. In the subsequent development, each of these lines seems to have gained new characters while modifying or losing old ones.

REPRESENTATIVE SPECIMENS.—**New Mexico.** LINCOLN CO.: Ruidoso, *Fisher 65* (CAS, US); Mescalero Ind. Reservation, June 23, 1895, *Wooton* (US); White Mts., *Wooton 264* (DS, MO, NY, POM, RM, UC, US); White Mts., 5 mi. above Agency, *Wooton & P. Standley 3552* (US). OTERO CO.: Sacramento Mountains: Cloudcroft, *Cockerell 35* (RM), *E. D. Shulz 252* (US), Aug. 1914, *H. D. Slater* (US), Aug. 8, 1899, *Wooton* (POM), Aug. 15, 1899, *Wooton* (US), Aug. 1, 1916, *M. S. Young* (UC); Rolland Canyon, Cloudcroft, *Eggleston 14500* (US); Sacramento Mountains: James Canyon, July 23, 1899, *Wooton* (NY), July 6, 1899, *Wooton* (DS,

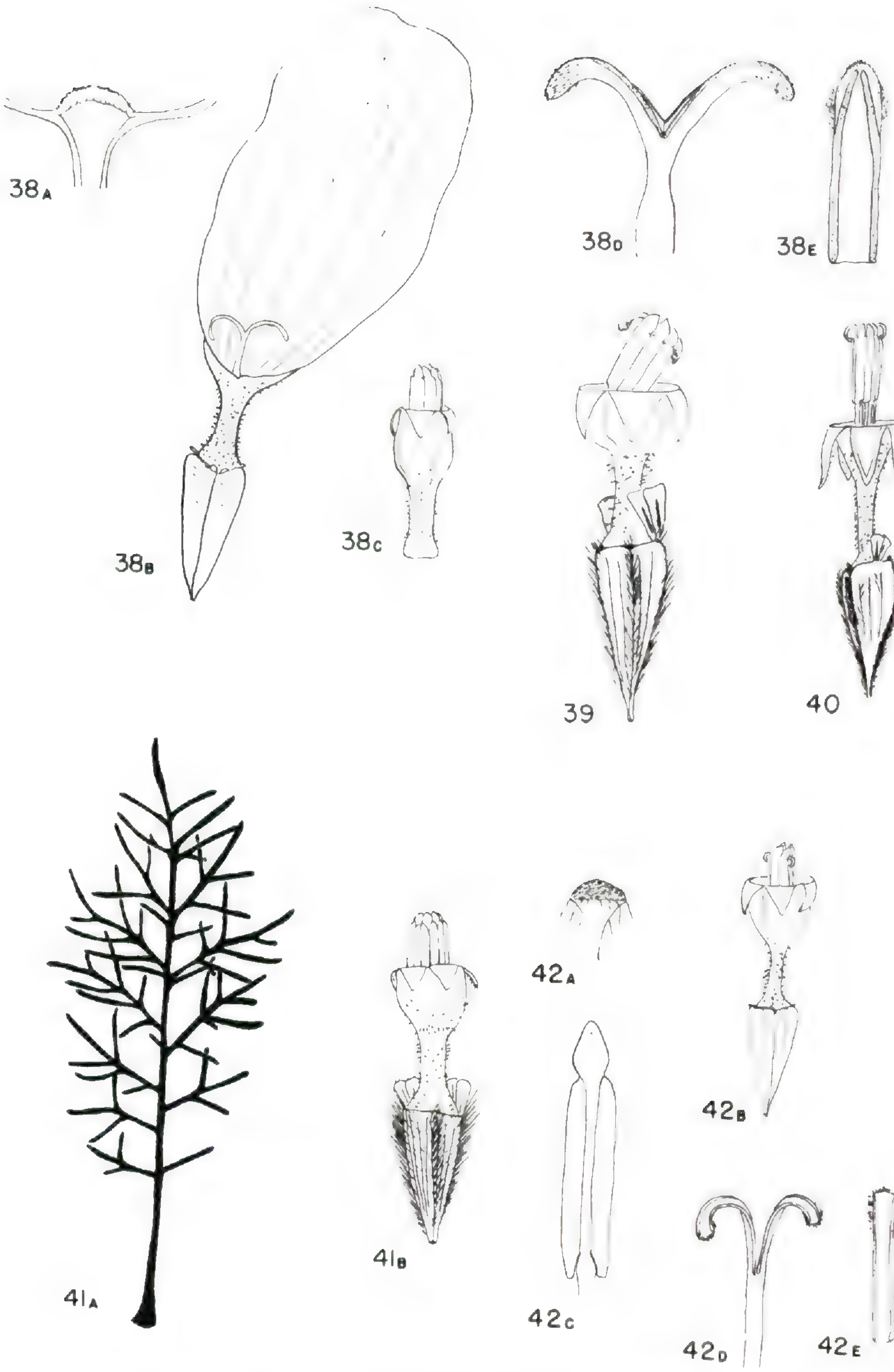


FIG. 38–42. Morphology of *Hymenopappus* species, Series Biennes. Fig. 38. *H. biennis* (Isotype); (a) receptacle, long. sec., × 4; (b) radial floret, × 8; (c) disk corolla, × 8; (d) style branches, × ca. 45; (e) upper surface of style branch, × ca. 45. Fig. 39. *H. flavescens* var. *canotomentosus* (Type), floret, part of pappus removed, × 8. Fig. 40. *H. artemisiaefolius* var. *artemisiaefolius* (*Lindheimer 107*, Fasc. II), floret, part of pappus removed, × 8. Fig. 41. *H. tenuifolius* (*T. 2895*); (a) silhouette of basal leaf × ⅓; (b) floret, part of pappus removed, × 8. Fig. 42. *H. flavomarginatus* (Type); (a) receptacle, × 4; (b) floret × 8; (c) anther, × ca. 40; (d) style branches, × ca. 40; (e) upper surface of style branch, × ca. 40.

UC, US); White Mts., above Mescalero, Aug. 4, 1901, *Wooton* (US); Tularosa Cr., 3 mi. S. of Mescalero Agency, *C. B. Wolf 2762* (CAS, DS, GH, RSA). SANDOVAL CO.: Sandia Mts., near Oshan Springs, Aug.–Sept., *C. E. Ellis 345* (MO). SIERRA CO.: Lookout Mines, south end of Black Range, *Metcalfe 1176* (CAS, MO, US). SOCORRO CO.: Oscuro Mts., July 21, 1898, *F. S. Earle* (MO, NY). **Texas.** CULBERSON CO.: Guadalupe Mts., in "The Bowl," summit of Pine Top Mt., *Correll 13920* (SMU); Guadalupe Mts., Oct., 1881, *V. Havard* (US); S. McKittrick Canyon, Guadalupe Mts., *Hinckley 4472* (US); ridge above McKittrick Canyon, July 17, 1931, *Moore & Steyermark 3484* (CAS, DS, GH, MO, NY, UC); Guadalupe Mts., S. McKittrick Canyon, *Muller 8287* (SMU, WS).

### 6. **Hymenopappus flavomarginatus** Johnston

*Hymenopappus flavomarginatus* Johnston, Contrib. Gray Herb. n.s. **68:** 95. 1923. Type examined (GH): Mexico. Coahuila. "Can[y]on and elevated portion of Sierra Madre, 12 to 14 leagues south of Saltillo, Mexico; July 25 to August 1st—1880" (data from isotype label, US), *E. J. Palmer 650.*

Plants biennial, 30–100 cm. high, sparsely canescent to glabrate; larger rosette leaves 6–12 cm. long, bipinnately dissected with linear ultimate divisions mostly 5–20 mm. long, 1–2 mm. wide, the petioles often reddish at base, comprising less than ½ the leaf length; stem leaves 10–20, becoming reduced up the stem; heads per stem 10–30, campanulate, 30–100-flowered, on ultimate peduncles 3–11 cm. long, these with conspicuous membranous basal bracts, 4–9 cm. long, 3–7 mm. wide; inflorescence an open cymose panicle; principal involucral bracts broadly obovate to oval, 6–9 mm. long, 4–8 mm. wide, yellow-membranous (often red-tinged) for 1–3 mm. from the broadly obtuse tip; corollas "yellow," 2.7–3.5 mm. long, the tube 1.5–2 mm. long, densely glandular-pubescent to nearly glabrate, the throat campanulate, 1.2–1.5 mm. long with lobes reflexed, 1–2 times longer than the lobes; achenes obpyramidal, 4-sided essentially glabrous, 3–4 mm. long; pappus of 18–22 minute scales (0.1–0.2 mm. long) or obsolete; anthers not completely exserted, about 2 mm. long; chromosome number not known.

DISTRIBUTION.—Known only from pine and oak woodlands in the mountains of north-central Mexico, states of Coahuila, Nuevo León, and San Luis Potosí, 7500–9000 ft. (Fig. 25). May–August.

This is a well marked species, undoubtedly belonging close to the *H. flavescens* and *H. tenuifolius* groups as suggested by Johnston in his original description. Its closest relationship seems to be with *H. biennis*, however, for in total characters it resembles this species of *Hymenopappus* more than any other member of the genus, differing principally in the lack of rays and in the broader involucral bracts. It also has some characters of *H. artemisiaefolius* such as the large, membranous peduncular bracts of that species. In short, the species has characters

which connect it to nearly all of the more primitive members of the genus, suggesting that it is of an old age and has developed along its own line, retaining some characters and losing others.

Representative specimens.—Mexico. **Coahuila.** 24 kilometers N. W. of Fraile, 2900 meters, July 15, 1941, *Stanford, Retherford & Northcraft 421* (DS, MO, NY, UC). **Nuevo León.** Municipio de Galeana, Haciendo Cieneguillas on Cerro Potosí, 8000 ft., Aug. 7, 1938, (students of) *Mexican Biological Expedition, University of Illinois* (GH, MO, NY). **San Luis Potosí.** Charcas, Santo Domingo Road, July–Aug., 1934, *Lundell 5604* (DS, GH, MO, US).

### 7. **Hymenopappus tenuifolius** Pursh

*Hymenopappus tenuifolius* Pursh, Fl. Am. Sept. **2:** 742. 1814. *Rothia tenuifolius* O. Ktze. Rev. Gen. **1:** 361. 1891. Type collected "in upper Louisiana" by Bradbury; no specimen could be found in the American herbaria consulted. It was probably collected in what is now South Dakota. The description, combined with the statement that "the flowers are white," leaves little doubt as to its identity.

*Hymenopappus corymbosus* var. *nuttallii* T. & G. Fl. N. Am. **2:** 372. 1842. Type or isotype examined (GH): "Red River, Arkansas," without additional information, but probably collected by Nuttall in what is now southern Oklahoma.

*Hymenopappus tenuifolius* Nutt. non Pursh, in T. & G. Fl. N. Am. **2:** 372. 1842, as synonym of above.

Plants biennial, 40–150 cm. high; stems from a single tap-root (rarely 2 crowns forming on a root, especially on injured plants), erect, much-branched, angled and grooved, sparsely white-tomentose to more frequently nearly glabrous; leaves alternate, forming the first year a basal rosette, the larger basal leaves 8–15 cm. long, 4–5 cm. wide, bipinnately dissected with linear, filiform, ultimate segments 0.5–1.5 mm. wide, conspicuously impressed-punctate, the stem leaves 8–30, becoming reduced upwards; heads numerous (20–200), discoid, 25–50-flowered, on pubescent to glabrate ultimate peduncles 1–5 cm. long; inflorescence a flat-topped cymose panicle; involucre campanulate, the principal bracts mostly glabrate (rarely tomentose) or densely glandular, 5–8 mm. long, 2–4 mm. wide, yellowish-membranous for 1–2 mm. from the acute to obtuse tip; corollas white, 2.5–3 mm. long, the tube glandular, 1.5–2.2 mm. long, the throat campanulate, 0.8–1.5 mm. long with lobes reflexed, 1.5–2 times longer than the lobes; achenes 3.5–4.5 mm. long, 4-sided, the faces 2–3-nerved, pubescent principally on the corners with hairs 0.5–1 mm. long; pappus of 16–18 linear oblong scales, 1–1.5(–2) mm. long; anthers mostly completely exserted, 2–2.5 mm. long; $n = 17$.

Distribution.—Common on the southern Great Plains of the central United States from South Dakota to south-central Texas in sandy or, less frequently, gravelly or rocky limestone soils; also in New Mexico on intermontane plains (Fig. 43). Late May–August.

*Hymenopappus tenuifolius* overlaps several related taxa in its range, but evidence of present-day hybridization and possible introgression is found in relatively few localities. One such area is in the Panhandle of Texas where small, less leafy, wooly-stemmed individuals are occasionally found, suggesting possible contamination of the species from disjunct, perennial, white-flowered races of *H. filifolius* var. *cinereus*, a taxon the normal range of which is in the Rocky Mountains (Fig. 37). This is of interest since it has been suggested that the perennial, yellow-flowered tetraploid, *H. filifolius* var. *polycephalus* (a member of the northern Great Plains flora) is possibly the

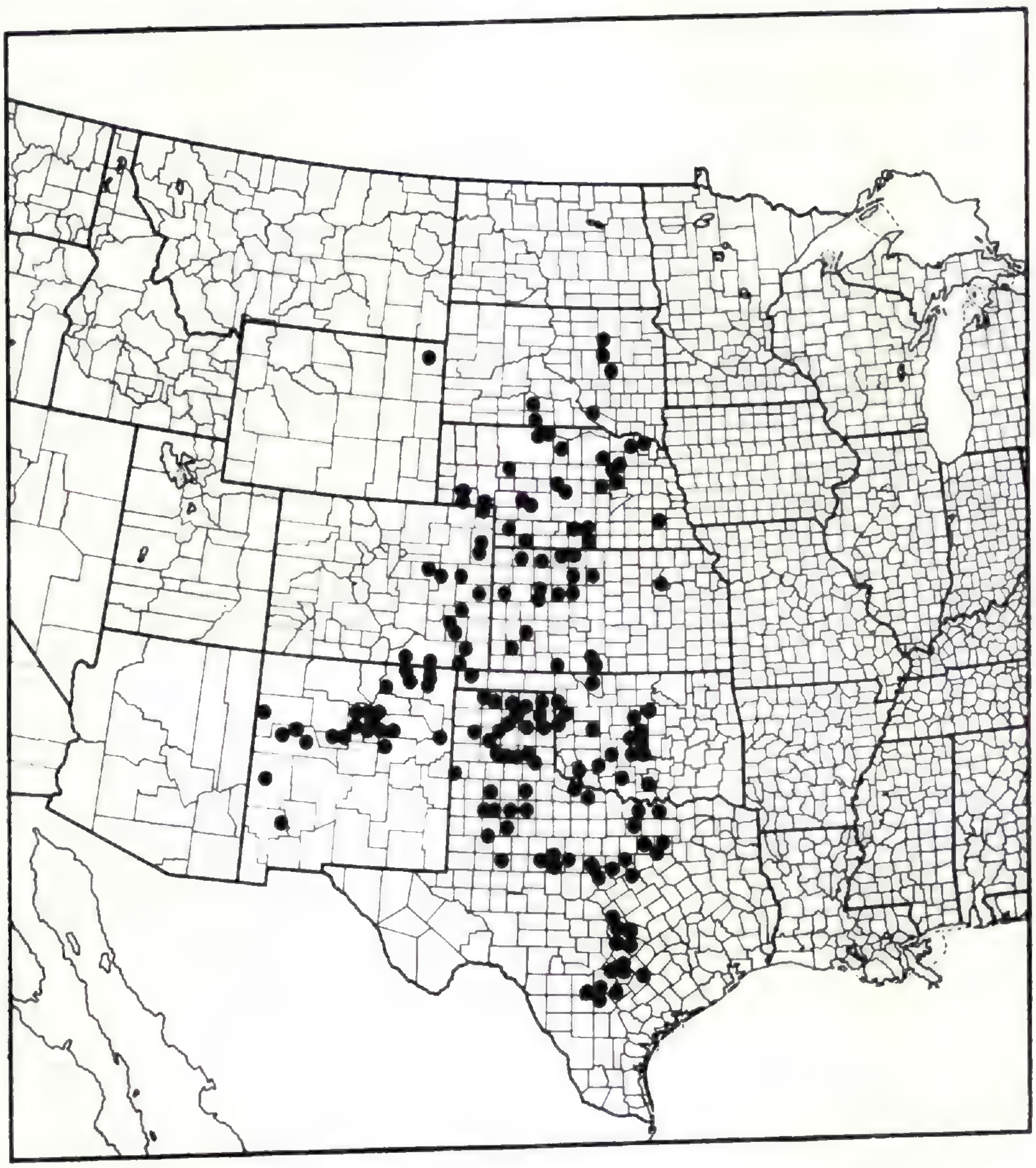

FIG. 43. Distribution of *Hymenopappus tenuifolius*.

result of amphiploidy between *H. tenuifolius* and *H. f. cinereus* (see discussion under *H. f. polycephalus*). Natural hybridization of these two taxa in the Panhandle of Texas would seem to add support to such an hypothesis.

The isolation of *H. tenuifolius* from the adjacent, more easterly taxon, *H. scabiosaeus* var. *corymbosus*, where the two species overlap, is perhaps partly seasonal, the latter entity having its principal flowering time 3–4 weeks before *H. tenuifolius*.

Representative specimens.—**Colorado.** Baca co.: Springfield, *Osterhout 5054* (RM). Bent co.: Las Animas, *Osterhout 3915* (RM). Cheyenne co.: Plains near Cheyenne Wells, July 12, 1887, *C. H. Demetrio* (GH). Elbert co.: about 25 mi. E. of Kiowa, *M. Ownbey 1293* (GH, MO, NY, RM, UC, WS). Kiowa co.: Eads, *Baker, Earle & Tracy 1029* (MO, POM). Las Animas co.: Mesa de Maya, 60 mi. E. of Trinidad, *Rollins 1838* (GH, MO, NY). Lincoln co.: E. of Limon, *Osterhout 8226* (RM). Otero co.: Apishipa Cr., *Osterhout 2043* (GH, NY, RM). Sedgwick co.: Julesburg, *Osterhout 4907* (RM). Yuma co.: Wray, *Osterhout 3983* (RM).

**Kansas.** Barber co.: 5 mi. S. W. of Medicine Lodge, *Rydberg & Imler 684* (MO, NY). Clark co.: 6 mi. W. of Englewood, *Rydberg & Imler 834* (NY). Decatur co.: Jennings (no additional data) (MO). Ellis co.: 12 mi. N. of Hays, *E. Runyon 130* (CAS, GH, MO, RM). Finney co.: near Garden City, *Coville 27* (US). Grove co.: plains, *A. S. Hitchcock 287* (GH, MO, NY, RM, US). Grant co.: Ulysses, *C. H. Thompson 24* (MO, US). Norton co.: Almenz, *Harshbarger* (US). Osborne co.: within 5 mi. of Osborne City, *Shear 71* (GH, NY, RM). Phillips co.: Long Island, June 15, 1885, *J. B. Hatcher* (UC). Rawlins co.: Atwood, May 30, 1891, *L. Fry* (NY). Riley co.: Manhatten, 1892, (w/o collector) (NY). Rooks co.: Rockport, June 10, 1891, *E. Bartholomew* (UC). Trego co.: Wakeeney, July 8, 1892, *M. Reed & A. D. H.* (NY). Wallace co.: Wallace, Aug. 22, 1884, *Letterman* (MO, NY, US).

**Nebraska.** Antelope co.: Neligh, June 3, 1906, *E. S. Bacon* (GH). Boone co.: 4 mi. W., 1.5 mi. N. of Lorette, *B. Osborn 1216R* (MO). Brown co.: Lone Pine, July 13, 1899, *J. M. Bates* (GH, RM). Cedar co.: Beaver Cr., *F. Clements 2664* (NY, UC, US). Chase co.: S. E. of Enders, Frenchman Valley, *Tolstead 41427* (MO). Cherry co.: near Valentine, *Tolstead 339* (GH). Cheyenne co.: N. of Sidney, *Osterhout 7196* (MO, RM). Custer co.: Broken Bow, July 4, 1889, *H. J. Webber* (MO, NY). Deuel co.: Rush Cr., *Rydberg 194* (NY). Franklin co.: Franklin, July 4, 1930, *H. Hapeman* (WS). Grant co.: Whitman, June 20, 1938, *E. Anderson* (MO). Greely co.: Greely Center, July 4, 1889, *T. A. Williams* (US). Hitchcock co.: near Culbertson, *Tolstead 411426* (MO). Holt co.: Ewing, June 19, 1899, *J. M. Bates* (GH). Kearney co.: dry prairie, June 28, 1894, *J. E. Bodin* (NY, POM, RM). Lancaster co.: prairie formations, Sept., 1898, *G. G. Hedgcock* (MO). Lincoln co. Hershey, *C. D. Mill 73* (NY, US). Phelps co.: sand hills, *Rydberg 194* (NY, US).

**New Mexico.** BERNALILLO CO.: Sandia Mts., Tijiras Canyon, *C. C. Ellis 459* (MO, NY, US). CATRON CO.: Patterson, Aug. 15, 1900, *E. O. Wooton* (US). COLFAX CO.: Cimarron Canyon, *Mathias 554* (MO, POM). GRANT CO.: near San Lorenzo, July 26, 1906, *E. Wooton* (US). GUADALUPE CO.: Anton Chico to Santa Rosa, *Arsène & Benedict 16686* (CAS). MCKINLEY CO.: Gallup, *Degener 4831* (NY). QUAY CO.: Logan, May 31, 1911, *E. Wooton* (US). SAN MIGUEL CO.: vicinity of Las Vegas, Romeroville, *Arsène & Benedict 15480* (US). SANTA FE CO.: 14 mi. S. of Santa Fe, July 7, 1951, *Turner 2895* (SMU, WS). UNION CO.: Emery Gap to Branson, Colorado, *Eggleston 20156* (GH, NY). VALENCIA CO.: Alamositas Canyon, July 15, 1906, *Wooton* (US).

**Oklahoma.** CADDO CO.: Cement, *Demaree 12540* (MO, NY). CARTER CO.: 4 mi. N. E. of Ardmore, *G. E. Hall 123* (RM). CIMARRON CO.: 11 mi. N. of Boise City, *R. Stratton 454* (MO). CLEVELAND CO.: 4 mi. W. of Norman, *Demaree 12772* (MO, NY). COMANCHE CO.: Wichita Nat'l. Forest, June 12, 1926, *A. J. Ortenburger* (US). CUSTER CO.: 1 mi. W. & 1 mi. S. of Weatherford, *Waterfall 5513* (GH). ELLIS CO.: Canadian R. valley, near Pack Saddle Bridge, *Goodman 2598* (GH, MO, NY, RM). JACKSON CO.: near Snyder, *G. W. Stevens 1275* (GH, NY). LOGAN CO.: near Guthrie, *G. W. Stevens 3324* (NY). MCCLAIN CO.: Johnson's Pasture, *Eskew & Barkley 1202* (MO). OKLAHOMA CO.: 5 mi. E. & 4.5 mi. N. of Oklahoma City, *Waterfall 1311* (NY). PAYNE CO.: 14 mi. S. W. of Stillwater, *Stratton 3753* (CAS). ROGER MILLS CO.: Roger, Antelope Hills, *Ortenburger 114* (US). STEPHENS CO.: S. of Comanche, *Waterfall 3680* (NY). WOODS CO.: July 6, 1900, *P. J. White* (RM).

**South Dakota.** BEADLE CO.: Huron, July 11, 1896, *T. A. Williams* (MO). CHARLES MIX CO.: Colvin, Aug. 29, 1892, *E. T. & S. A. Harper* (US). MELLETTE CO.: Valley of White R., May 1855, *F. V. Hayden* (NY). SPINK CO.: Northville, *J. F. Brenckle 41–69* (CAS, GH, MO, NY, SMU). TODD CO.: Highland, Antelope Cr., *E. J. Wallace 22* (NY).

**Texas.** ANTASCOSA CO.: 12 mi. N. of Pleasanton, *Cory 19178* (GH). ARMSTRONG CO.: Gamble's Ranch, *E. J. Palmer 13912* (MO). BEXAR CO.: 15 mi. S. of San Antonio, *Schulz 421* (US). BOSQUE CO.: 12 mi. N. N. E. of Walnut Springs, *Shinners 10067* (SMU). CALLAHAN CO.: Baird, Aug., 1882, *Letterman* (GH, MO). COMAL CO.: New Braunfels, *Dapprich 6207* (SMU). COMANCHE CO.: Round Top Mt., May 9, 1900, *H. Eggert* (MO). COOKE CO.: Tyler Bluff, western edge of county, *D. S. & H. S. Correll 12996* (SMU). CROSBY CO.: 3 mi. E. of Crosbyton, *Shinners 8362* (SMU). DALLAS CO.: Dallas, May, 1876, *J. Reverchon* (MO, NY). DAWSON CO.: between Lamesa and Tahoka, *Small & Wherry 12130* (NY). DICKENS CO.: 1.5 mi. E. of Dickens, *Shinners 8379* (SMU). DOWLEY CO.: 7 mi. N. W. of Memphis, *Innes & Moon 1013* (GH). GARZA CO.: Post, *E. J. Palmer 13856* (MO, US). GONZALES CO.: Waelder, July 9, 1889, *M. Hopkins* (US). HANSFORD CO.: 5 mi. S. E. of Gruver, *L. H. Shinners 8233* (SMU). HAYS CO.: San Marcos and vicinity, Sept. 1, 1896, *S. W. Stanfield* (NY). HEMPHILL CO.: 5 mi. S. of Canadian, *Shinners 8280* (GH, SMU, UC). HOOD CO.: prairies N. of Granbury, May 4, 1900, *H.*

*Eggert* (MO). HOWARD CO.: prairies N. of Big Springs, June 11, 1900, *Eggert* (MO). HUTCHINSON CO.: 2 mi. S. of Borger, *Shinners 8092* (SMU). LAMPASAS CO.: 1 mi. S. of Lampasas, *Whitehouse 15381* (SMU). LIPSCOMB CO.: Lipscomb, *A. H. Howell 41* (US). LUBBOCK CO.: Posey Canyon, *Demaree 7574* (GH, MO, WS). MEDINA CO.: 2.75 mi. S. W. of Devine, *Cory 12814* (GH). MOTLEY CO.: 16.4 mi. E. of Matador, *Whitehouse 9914* (SMU). NOLAN CO.: 3 mi. E. of Sweetwater, *Waterfall 6736* (GH). OCHILTREE CO.: 8 mi. S. S. W. of Perryton, *Shinners 8265* (SMU). OLDHAM CO.: Magenta, *Shinners 8158* (SMU). PARMER CO.: Bovina, *F. S. Earle 684* (NY). POTTER CO. 5 mi. S. of Canadian R., highway 287, *B. & H. Jespersen 2695* (DS, MO, RM, UC, SMU, WS). RANDALL CO.: 15 mi. E. of Canyon, Palo Duro State Park, *Shinners 8023* (SMU, WS). ROBERTS CO.: 2.5 mi. S. W. of Miami, *Shinners 8310* (SMU). SHERMAN CO.: 25 mi. E. and 4 mi. S. of Stratford, *Shinners 8223* (SMU). TAYLOR CO.: Camp Barkeley, *Tolstead 7024* (MO, SMU, UC). TRAVIS CO.: Glen Rose, divide between Cow and Sandy Creeks, *R. T. Hill 9* (US). WICHITA CO.: 10.7 mi. N. of Electra, *Whitehouse 10489* (SMU). WILBARGER CO.: 6.5 mi. N. of Oklaunion, S. side of Red R., *Whitehouse 10961* (SMU). WILSON CO.: Kicaster School, *Cory 15144* (GH). WISE CO.: 3 mi. W. of Decatur, *Shinners 7934* (SMU).

**Wyoming.** CROOK CO.: Bear Lodge Mts., Aug., 1897, *D. Griffiths s.n.* (MO). This record should be checked since, if correct, it represents a considerable extension of range for the species.

### 8a. **Hymenopappus flavescens** Gray, var. **flavescens**

*Hymenopappus flavescens* Gray, Mem. Am. Acad. Arts. Sci. n.s. **54** (1): 97–98. 1849. *Rothia flavescens* (Gray) O. Ktze. Rev. Gen. **1:** 361. 1891. Type examined (GH): New Mexico. "Between San Miguel and Las Vegas, 10 miles W. of Vegas," Aug. 14, 1847, *A. Fendler 464*. Locality cited is that on isotypic material at MO.

*Hymenopappus fisheri* Wooton & Standley, Contrib. U. S. Natl. Herb. **16:** 191. 1913. Type examined (US): New Mexico. Quay Co.: "Collected at Nara Visa, clay and sand soil," Sept. 8, 1910, *G. L. Fisher 16*.

Plants biennial, 45–90 cm. high, the stems single from each tap-root; larger rosette leaves 6–14 cm. long, sparsely canescent to glabrate above, densely tomentose below (rarely tomentose on both surfaces). bipinnately parted (except for the first 1–4 leaves) with broad ultimate segments mostly 2–6 mm. wide; stem leaves 15–40, becoming reduced upward; heads 30–100 per stem, campanulate, 30–70-flowered, on short ultimate peduncles 0.5–3 cm. long; inflorescence a many-headed, mostly congested, cymose panicle; principal involucral bracts pubescent to glabrate, 4–5(–6) mm. long, 2–4 mm. wide, yellow-membranous for about 1 mm. from the acute or narrowly obtuse tip; corollas bright yellow, 2.5–3.5 mm. long, the tube densely to sparsely glandular, 1.5–2 mm. long, the throat abruptly campanulate to campanulate-funnelform, 0.8–1.5 mm. long, with lobes reflexed, as long as the lobes (rarely shorter); achenes obpyramidal, 4-sided, 3.5–4 mm. long, pubescent principally on the corners with

hairs 0.3–1 mm. long; pappus of 18–20 linear-oblong scales, 0.5–1(–1.2) mm. long; anthers mostly completely exserted, about 2 mm. long; $n = 17$.

Distribution.—Principally northwestern Texas on the Llano Estacado (Staked Plains) and its periphery; eastern New Mexico, western Oklahoma, southwestern Kansas and southern Colorado (known in this latter state by only one collection from along a roadside south of Trinidad), mostly in deep, red, sandy soils, commonly associated with "shinnery" (*Quercus* spp.) in the western part of its range (Fig. 46). Late May–September (See Fig. 44).

In the eastern part of its range (Hemphill Co., Texas) there is considerable intergradation of this variety with *Hymenopappus scabiosaeus* var. *corymbosus* with respect to corolla and leaf shape, pappus length, and general pubescence; in the western part of its range (eastern New Mexico) there is a similar but strong intergradation of these same characters with those typical of *H. flavescens* var. *cano-tomentosus*. This, combined with the ranges of the taxa involved, makes it seem probable that the variety is of hybrid nature, having had its origin at some past time, perhaps during a pluvial period, when the ranges of *H. scabiosaeus* var. *corymbosus* and *H. flavescens* var. *cano-tomentosus* had considerable overlap. With subsequent withdrawal of the putative parents at a later time, the hybrids and their derivatives were left isolated and have since evolved more or less independently. A similar situation has been hypothesized for some species of *Quercus* by Muller (1951). An alternate hypothesis would be that the variety has evolved, without this factor of hybridization, from *H. flavescens* var. *cano-tomentosus* entirely as a result of mutation and selection in its appropriate habitat and has since this initial isolation come into contact and introgressed with the two peripheral taxa mentioned. Experimental crosses between these entities should do much to offer positive evidence.

The taxon is placed as a variety within the same species as *cano-tomentosus* since it resembles this taxon phenotypically more than it does *H. scabiosaeus* var. *corymbosus*, perhaps indicating that it has drawn a larger number of characters from the latter by the hybridization and introgression visualized above.

Figure 44 has been constructed from information tabulated by the method given in the footnote, p. 241. By comparison

of the flowering dates of the taxa mentioned, it will be noticed that var. *corymbosus* begins flowering early, rapidly reaches a peak, then drops off less sharply leaving only a few late-flowering individuals which overlap into the longer, continuous flowering period of var. *cano-tomentosus*. Assuming that var. *flavescens* became partially isolated seasonally from *H. scabiosaeus* var. *corymbosus*, either as a result of hybridization or mutation, it is clear that present crossing and resulting introgression will be more with *H. flavescens* var. *cano-tomentosus* than *H. scabiosaeus* var. *corymbosus* since there would be more opportunities for crossing with the former.

*Hymenopappus flavescens* was reduced to synonymy under *H. corymbosus* by Johnston (1923) with the following statement, "Gray's *H. flavescens* was based upon a good specimen of the present species, *H. corymbosus* collected by Fendler, and upon a few fragments, apparently of *H. artemisiaefolius*, which were collected by Wislizenus." However, *H. flavescens* as defined by Gray may be distinguished immediately throughout its range from *corymbosus* by its later blooming period, yellow flowers, and more campanulate corolla-throat; the latter is

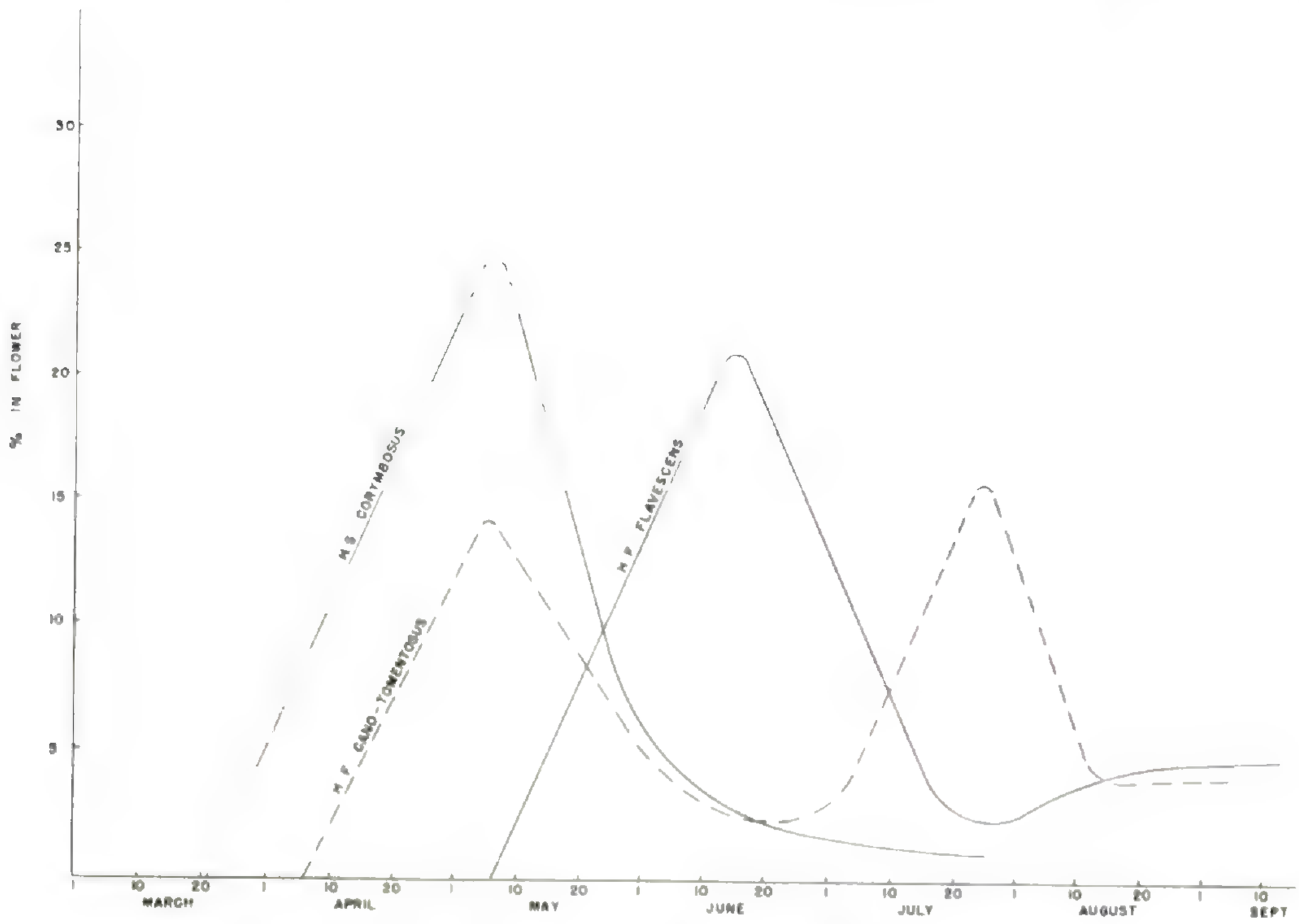


Fig. 44. Graph showing dates of flowering expressed in per cent of herbarium specimens examined from eastern New Mexico, Texas, and western Oklahoma.

white flowered and has a predominately funnelform throat. Fendler's collections (type and isotypes) are biologically typical specimens of *H. flavescens* as are Wislizenus' fragments. *H. artemisiaefolius* is a species of the pine woods in eastern Texas, and certainly was not collected by Wislizenus on the "Santa Fe Road" in New Mexico.

REPRESENTATIVE SPECIMENS.—**Colorado.** LOS ANIMAS CO.: 12 mi. S. of Trinidad, highway 87, May 29, *Brenckle 48139* (SMU). **Kansas.** GRANT CO.: Ulyesses, *Thompson 64* (MO, US). HAMILTON CO.: sandhills, *A. S. Hitchcock 607 (286)* (GH, MO, NY, RM). SEWARD CO.: W. of Liberal, *McKelvey 2488* (GH, POM). STEVENS CO.: sandhills, *H. W. Norris 91* (MO). **New Mexico.** CHAVES CO.: 7 mi. N. E. of Boaz, *Waterfall 4321* (GH, MO, NY). DE BACA CO.: La Lande, *Pohl 5036* (SMU). EDDY CO.: near Loving, *Standley 40361* (US). LEA CO.: 5 mi. N. of Eunice, *Turner 2947* (SMU, WS). LINCOLN CO.: 35 mi. W. of Roswell, *F. S. & E. S. Earle 508* (NY). QUAY CO.: Nara Visa, *G. L. Fisher 16* (RM, US). ROOSEVELT CO.: 5 mi. N. E. of Portales, *Goodman & Hitchcock 1123* (CAS, DS, GH, MO, NY, RM, UC). SAN MIGUEL CO.: between San Miguel and Las Vegas (10 mi. W. of Vegas), *Fendler 464 (417)* (GH, MO). SANTA FE CO.: near La Glorieta, *Brandegee 12068* (MO, UC). UNION CO.: Willow Bar of the Cimarron, *Fendler 463 (417)* (MO). **Oklahoma.** BECKHAM CO.: Sayre, *R. Stratton 338* (MO). DEWEY CO.: W. of Vici, *Goodman 2577* (CAS, GH, MO, NY, RM). WOODWARD CO.: Indian Cr. Station, 7 mi. S. E. of Woodward, *A. & R. Nelson 5651* (RM).

**Texas.** BAILEY CO.: 5 mi. N. W. of Muleshoe, *Correll 13107* (SMU). CASTRO CO.: Dimmitt, *E. L. Reed 3558* (US). CHILDRESS CO.: 9 mi. N. of Childress along Red R., *Whitehouse 18699* (SMU). CRANE CO.: near Crane, highway 51, *L. Cutak 3* (MO). CROSBY CO.: 30 mi. S. W. of Spur along Blanco R., *Erlanson 1196* (SMU). DALLAM CO.: 7 mi. N. W. of Dalhart, *Shinners 8176* (GH, RM, SMU, UC). DONLEY CO.: 9 mi. S. W. of Claredon, *Innes & Moon 1019* (DS, GH). FISHER CO.: 7.5 mi. E. of Roby, *Whitehouse 16724* (SMU). GAINES CO.: 15.1 mi. W. of Lamesa, highway 180, *Whitehouse 16779* (SMU). GARZA CO.: near Double Mt. R., *A. Ruth 1308* (US). HALL CO.: W. of Estelline, May 26, 1906, *Reverchon* (MO). HARDEMAN CO.: 12 mi. N. of Chillicothe, *Cory 13395* (GH). HARTLEY CO.: 10 mi. E. of Romero, *Cory 16464* (GH). HEMPHILL CO.: prairies N. of Canadian, June 7, 1901, *H. Eggert* (MO). HOWARD CO.: near Big Spring, *E. J. Palmer 34006* (MO, NY). KENT CO.: 1 mi. S. of Jayton, *Shinners 8387* (SMU). LAMB CO.: 8 mi. S. of Olton, *Cory 13550* (GH). LUBBOCK CO.: Lubbock, *Studhalter 1270* (US). MITCHELL CO.: N. of Colorado, June 9, 1900, *Eggert* (MO). POTTER CO.: 1.4 mi. S. of Canadian R. Bridge, highway 287, *B. & H. Jespersen 2686* (DS, MO, RM, SMU, UC, WS). RANDALL CO.: Palo Duro Canyon, *A. C. Martin 292* (US). RUNNELS CO.: Ballinger, *E. J. Palmer 10326* (DS, MO, US). TERRY CO.: Wellman, July 10, 1941, *B. C. Tharp* (GH, MO). WARD CO.: 3.5 mi. E. of Monohans, sand dunes, *C. H. Muller 8528* (SMU).

### 8b. **Hymenopappus flavescens** var. **cano-tomentosus** Gray

*Hymenopappus flavescens* var. *cano-tomentosus* Gray, Pl. Wright **2:** 94. 1852. Type examined (GH): "Sandhills near Frontera, New Mexico; April, May, " 1851–1852, *C. Wright 1412*. Quoted locality is that given in the type description.

*Hymenopappus canescens* var. *cano-tomentosus* Rothrock, in Wheeler Exped. **6:** 167. 1878. This name is apparently an error for *Hymenopappus flavescens* var. *cano-tomentosus* Gray.

*Hymenopappus robustus* Greene, Bull. Torr. Bot. Club **9:** 63. 1882. Probable isotype examined (GH): New Mexico. Grant Co.: "collected near Santa Rita del Cobre in 1877," *E. L. Greene s.n. (22)*. A type was not designated by Greene, only the phrase "common on the sandy plains of New Mexico" being used to identify the collections from which the description was drawn. The specimen cited above has the annotation "forma robusta" on the collection label, apparently put there by Greene himself. There can be little doubt that the plant referred to is *H. flavescens* var. *cano-tomentosus* Gray. It is apparently common on the plains near Silver City, New Mexico, where Greene resided at the time of his publication.

Plants biennial, 30–90 cm. high, the stems typically densely tomentose, single from each tap-root (rarely 2 crowns forming on injury); larger rosette leaves 6–15 cm. long, 2–4 cm. wide, evenly pubescent on both surfaces, usually densely tomentose, but often merely canescent, bipinnately dissected with the small, narrow, ultimate segments 1–2 mm. wide; stem leaves 10–50, becoming reduced upwards; heads 15–100 per stem, campanulate, 30–90-flowered, on ultimate peduncles 1–6 cm. long; principal involucral bracts (4–)5–8 mm. long, 2–4 mm. wide, densely tomentose to nearly glabrate, yellow-membranous for about 1 mm. from the acute to rarely obtuse tip; corollas yellow, 2.5–3.5 mm. long, the tube glandular, 1.5–2 mm. long, the throat abruptly campanulate 1–1.5 mm. long, with lobes reflexed, 1–1.5 times longer than the lobes; achenes obpyramidal, 4-sided, 3–4.5 mm. long, evenly pubescent with hairs 0.5–1.5 mm. long; pappus of 16–22 linear oblong scales, 1–1.5 mm. long (very rarely less); anther usually completely exserted, 1.8–2.2 mm. long; $n = 17$.

Distribution.—Gravelly, rocky, sandy or sandy limestone soils on intermontane plains of Trans-Pecos Texas, western New Mexico, eastern Arizona and adjacent areas of Mexico (Fig. 46). Flowering at two principal times: late April to May and again in late July to early August (Fig. 44), apparently depending on rainfall.

*Hymenopappus flavescens* var. *cano-tomentosus* can be distinguished from the closely related var. *flavescens* by its more finely dissected leaves with narrow segments and by its generally shorter pappus and involucral bracts. However, at the eastern periphery of its range, it intergrades almostly completely with

var. *flavescens* (see discussion under that variety). Otherwise, it is essentially free of contamination from other taxa. As an exception is a single collection which seems to represent a clear hybrid between var. *cano-tomentosus* and some member of the *H. filifolius* complex (probably var. *cinereus* or var. *lugens*): Arizona. Navajo Co.: Kayenta, 1922, *John Weterill s.n.* (NY). The specimen is tall and leafy as is var. *cano-tomentosus*, but the leaves (which are obviously atypical) and the woolly stems approach those of *H. filifolius*. The inflorescence is apparently retarded in its development, being represented by a tight, abnormal cluster of heads at the stem apex.

REPRESENTATIVE SPECIMENS.—**Arizona.** APACHE CO.: Adamana, Sept. 1, 1909, *H. M. Rusby* (NY). GILA CO.: Tonto Hill, *Collom 163* (GH, MO, NY, US). GRAHAM CO.: between Safford and Globe, *Peebles 14601* (US). NAVAJO CO.: 14 mi. E. of Holbrook, *Goddard 698* (UC). PIMA CO.: Santa Catalina Mts., *Lemmon 218* (GH). **New Mexico.** BERNALILLO CO.: Albuquerque Mesa, *Castetter 1228* (RM). CATRON CO.: 8 mi. S. W. of Horse Springs, *Preece & Turner 2738* (SMU, WS). DE BACA CO.: Buchanan, Aug. 12, 1909, *Wooton* (US). DONA ANA CO.: Organ Mts., *Wooton 139* (DS, MO, NY, POM, RM, UC, US). EDDY CO.: 10 mi. W. of Hope, Aug. 4, 1905, *Wooton* (US). GRANT CO.: Whitewater Junction, Silver City *Eastwood 8530* (CAS, GH). LUNA CO.: Nutt, *Diehl 751* (POM). SAN JUAN CO.: 45 mi. N. W. of Cuba, *Preece & Turner 2753* (SMU, WS). SOCORRO CO.: near Socorro, Aug., 1880 (1881), *H. H. Rusby 180* (MO, NY, WS). TORRANCE CO.: Willard, Aug. 26, 1904, *Wooton* (US). VALENCIA CO.: E. of Laguna Pueblo, *A. & R. Nelson 2176* (MO, RM). **Texas.** CULBERSON CO.: 2 mi. W. of Van Horn, *Waterfall 4409* (CAS, GH, MO, NY, SMU). ECTOR CO.: Odessa, *E. L. Reed 1907* (US). EL PASO CO.: El Paso, May, 1881, *G. R. Vasey* (DS, GH, US). HUDSPETH CO.: 32 mi. W. of Sierra Blanca, highway 62, on pipe line road, *Tharp 46149* (RM, RSA, UC). LOVING CO.: 10 mi. E. of Mentone, *Turner 984* (SMU). PRESIDIO CO.: 2 mi. W. of Marfa, *Warnock 5592* (SMU). REEVES CO.: Saragosa, *Warnock 5271* (SMU). WARD CO.: Barstow, *Earle & Tracy 43* (NY).

MEXICO. **Chihuahua.:** near Paso del Norte, *Pringle 759* (GH, MO, NY, UC, US).

*(To be concluded)*

Lygodium palmatum vs. Urbanization.—The climbing fern, *Lygodium palmatum* (Bernh) Sw., was once so plentiful within the limits of what is now the city of Hartford, Conn., that it was locally known as the Hartford Fern. But residents of Windsor, adjoining Hartford on the north, found it in such abundance there that they insisted on calling it the Windsor Fern. Citizens of both these communities recognized its commercial value and collected it extensively for ornamental display. The Connecticut Legislature, in an attempt to preserve it from extermination, passed a law in 1869 making it an offense punishable by fine for any person to gather it without the consent of the owner on whose property it was growing. This law is still on the statute books of Connecticut.

Despite this legal attempt at its preservation the advance of civilization caused human habitations to occupy the habitats of these ferns, so that for a quarter century or more no plant of this fern has been found growing wild in either Hartford or Windsor. *Lygodium palmatum* is now so rare in the Connecticut valley that even professional botanists confess that they have never seen it growing in its natural surroundings; and nurserymen in Connecticut, Massachusetts and Vermont offer it for sale as a rare species.

Gray's Manual (8th edition) states that its range extends from Georgia north to southeast New York, southern New England, and west to Ohio and Kentucky. It would be of interest to both botanists and conservationists to have a report from the states outside New England as comprehensive and authoritative as that given by Dr. Shaver in his "Ferns of Tennessee." He also notes its appearance at four stations in Great Smoky Mountains National Park in West Virginia. Such a report would indicate to what extent this fern is withstanding the attacks of civilized humanity.

Herewith is a partial report of its status in the Connecticut Valley based on observations covering the last decade.

A small colony was discovered in a wooded area in Granby, Ct. by Mrs. Harry L. Oppenheimer, of Suffield, Conn., in 1950. Since that date the owner of the property has cleared his acres for building sites and eradicated the fern.

A similar colony was discovered in Wilbraham, Mass., near the Springfield line, and reported to me by Mr. R. A. Doray, of Greenfield, Mass. This station I visited in 1950, but I noted that it was very close to the highway and that the city was extending its tentacles dangerously near to the spot. On my last visit, in October 1955, I found one of these modern houses (two bedrooms and a two-car garage) occupying the site.

Mr. Doray reports that as recently as 1953 a sizeable colony persisted in a swamp off Tinkham Road, Springfield, a short distance from Wilbraham Road. Another station, in a pasture in North Amherst near the road to Sunderland, is apparently not yet threatened by real estate developments.

In the spring of 1955 Mr. Percy E. Fellows of Wethersfield, Conn. brought me a spray of the fern which he had found close to the highway in Rocky Hill, Conn. On visiting that spot some weeks later, all vegetation, including the fern, had become a ghastly brown, the result of spraying along the highway by the State Highway Department in its successful effort to destroy roadside weeds. Whether the fern will survive this treatment and make another attempt to survive next spring is problematical.

In Granby, Conn., along an abandoned wood road, a small colony was discovered in 1954. This station is known to the discoverer only. Also in Granby is another small colony on property owned by Johnson's Nursery of Southwick, Mass. This station is being perpetuated for commercial purposes and will be well guarded by the owner.

Near the Granby line, in Suffield, Conn., another colony was discovered in 1952. This is on property owned by a fern-lover who is determined to preserve this fern from destruction. Its location is known only to a few high-minded botanists. Its site will be revealed in the future only to those who respect the laws of Connecticut, who share the owner's desire that no plant shall be molested, and are content to observe the modified adage: "a fern in the wood is worth two in the hand."

It is high time that botanists, fern-lovers and conservationists throughout the country enter into a compact to save this lone American species of *Lygodium* from extermination.—Jesse F. Smith, suffield, conn.

Clarence R. Hanes.—The death of Mr. Hanes on February 10, 1956, brought to a close the career of one of Michigan's most active field botanists. Clarence Robert Hanes was born March 26, 1874, in the family home in Schoolcraft, Michigan, where he lived for the rest of his life (except while away at school). He farmed the family property in the vicinity, and was very active in civic affairs. Upon graduation from Schoolcraft High School, where he concentrated in languages, he continued his studies at the University of Michigan, from which he graduated in 1898. In 1911, he married Florence Nutten, who later shared with him a quarter century of intensive study of the local flora.

Started as an avocation in the early 1930's, the Hanes' floristic work was originally limited to the area within five miles of their home in Schoolcraft, Kalamazoo County, Michigan. Botanical authorities to whom they sent some of their unusual finds urged that they extend their study to the entire county. Subsequent years of thorough field work culminated in the publication of their flora of the county in 1947.[1] This remains the finest county flora yet produced for the state of Michigan—and one of the few really good local floras for the entire Great Lakes region. Until Mr. Hanes' death, he and his wife continued their collecting, with additional work in other counties of western Michigan. Mrs. Hanes, who did all of the mounting for the herbarium in addition to sharing fully in the field work, has been completing the mounting of some recent collections from other counties.

Much of the area about Schoolcraft was covered by Mr. Hanes on his bicycle, while their old farm truck carried them to more distant areas. Other Kalamazoo County residents whose collections and interest aided the Hanes' studies included H. R. Becker (who also died in February), Dr. L. A. Kenoyer of Western Michigan College, and Fred W. Rapp. The herbarium contains many critical species determined by specialists to whom material was sent. Of particular significance was Hanes' collaboration with Liberty Hyde Bailey on the genus *Rubus*, over 20 new species of which were described by Bailey from Kalamazoo County (including *R. hanesii*, *R. florenceae* [named for Mrs. Hanes], *R. schoolcraftianus*, and *R. kalamazoensis*). Another

[1] Clarence R. Hanes and Florence N. Hanes, *Flora of Kalamazoo County, Michigan. Vascular Plants.* Schoolcraft, Michigan, 1947. xii + 295 pp. (Reviewed in *Rhodora* 49: 143–144. 1947.)

valuable collaboration was with F. J. Hermann on the genus *Carex*, many new county and state records having resulted from the Hanes' field work in southwestern Michigan.

The Hanes herbarium has been given to Western Michigan College in Kalamazoo, where it is housed in the "Clarence R. Hanes Room," dedicated May 2. The herbarium is to be kept as a unit, neither being distributed among other collections nor having additions inserted, until such time as a flora of Michigan is published. Given with the herbarium was a large record book in which notes and observations are recorded geographically, by the various localities in the vicinity.

The discoverer of many species previously unknown from Michigan, Mr. Hanes published his findings primarily in the *Papers* of the Michigan Academy of Science, Arts, and Letters. He also submitted a number of notes to RHODORA, of which the most recent was published in January, 1956.—EDWARD G. VOSS AND JAMES S. WILSON, UNIVERSITY OF MICHIGAN, ANN ARBOR.

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FLORA OF WINNEBAGO COUNTY, ILLINOIS[1].—Local floras are valuable as supplements to state and regional floras. By confining their data and subject matter to the local vegetation, they emphasize many aspects of a flora that are lost or otherwise not evident in state and regional manuals. Local floras furthermore reflect the intensive concentrated work of an enthusiastic botanist who has devoted all his spare moments to these interests. To such a category of devout enthusiastic workers Dr. Fell belongs. By profession a physician, his avocational interest throughout his life has been centered on the collecting and study of the native flora of this northern Illinois county, in which the city of Rockford is located.

The present volume represents the results of a life time of study and is an admirable contribution to add to other recent works relating to the Illinois flora. Actually, it is an expanded treatment of the Check list of the vascular plants of Winnebago County, Illinois, published in 1949 (Trans. Ill. Acad. Sci. 42: 68–79) by George D. Fuller, E. W. Fell, and G. B. Fell.

The book under review is packed with the type of phytogeo-

[1] FELL, EGBERT W. Flora of Winnebago County, Illinois. Nature Conservancy. Washington, D. C. 1–207, illustrated. 1955.

graphical and ecological information which furnishes the reader with data he could not easily find elsewhere if at all. In addition to such topics as climate, geology and physical features, types of habitats within the county, there are interesting units discussed under the distribution of species, and plant refuges. The discussion of the last topic reflects Dr. Fell's profound intimacy with the flora of the region. Altogether, 1210 species of vascular plants (ferns and flowering plants), of which 1013 are native, are treated in the flora. The data are based upon the extensive herbarium specimens collected by Dr. Fell, as well as upon those of M. S. Bebb, Evelyn I. Fernald, and various other local botanists and collectors. Eighty seven illustrations of various species, five photographs representing different kinds of habitats, one photograph of M. S. Bebb, a map of Winnebago County showing distribution of prairie and woodland, and of names of places mentioned in the flora, and a detailed index serve to widen the usefulness of the book.

Categories below the species level are not recognized, a practice with which many botanists will not be in agreement. The adherence to "species only" concept has led to the maintenance of *Botrychium dissectum* and *B. obliquum*, and of *Dryopteris spinulosa* and *D. intermedia* as distinct species, whereas most fern students have treated these as forms or varieties. Again, this style has led to the listing of *Lespedeza longifolia* DC. as a distinct species. However, as brought out in the eighth edition of Gray's Manual, *L. longifolia* DC. is a little known eastern plant, and the proper position of it is in varietal rank under *L. hirta*. It has no close taxonomic relationship with *L. capitata*, with which Dr. Fell has indicated it as "(*L. capitata* var. *longifolia*)." Many other similar cases could be specified, but this does not detract greatly from the general usefulness of the work.

Dr. Fell is to be congratulated for having brought out this splendid book, which definitely fills an important gap in the literature on the local flora and on Illinois plant geography and ecology.—Julian A. Steyermark, Chicago Natural History Museum, Chicago, Illinois and Missouri Botanical Garden, St. Louis, Missouri.

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# Rhodora

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## THE IDENTITY OF CALYPTOCARPUS BLEPHAROLEPIS


S. F. Blake


The type sheet of *Calyptocarpus blepharolepis* Robinson (Proc. Amer. Acad. **47** (Contr. Gray Herb. 39): 214. 1911) in the Gray Herbarium bears a printed label indicating that the material had been collected by *S. M. Tracy* (no. *8946*) at Tensaw, Alabama, August 18, 1904, and identified as *Calyptrocarpus*[1] *tampicanus* Small [= *Calyptocarpus vialis* Less.] by E. L. Greene. Both specimens on the type sheet are characteristic *Sanvitalia ocymoides* DC., matching very well a number of collections in the Gray Herbarium, including *Berlandier 2102* (type collection of *S. ocymoides*), *Berlandier 2233* (type collection of *S. tragiaefolia* DC., a synonym of *S. ocymoides*), *Pringle 1918*, and others. In the same herbarium is a sheet of true *Calyptocarpus vialis* Less. with printed label stating that it had been collected by *Tracy* (no. *8942*) at Corpus Christi, Texas, April 4, 1905, and determined by Greene as *Sanvitalia ocymoides* DC.

The specimen of *Tracy 8942* in the British Museum of Natural History, which I examined many years ago, agrees with that in the Gray Herbarium, and the specimen in the U. S. National Herbarium is like the others. The label of the sheet of no. *8946* in the latter herbarium, however, has only the heading printed, the remainder being in ink. It is labeled in Greene's hand *Calyptrocarpus tampicanus* Small; the number *8946* and the data —Brownsville, Texas, April 13, 1905—are in another handwriting, which Mrs. Agnes Chase identifies as that of S. M. Tracy

[1] Lessing's name *Calyptocarpus* has been persistently but improperly emended by authors to *Calyptrocarpus*.

himself. The plant itself is *Sanvitalia ocymoides*, like all the other specimens of *8946* examined.

This specimen (*8946*) is sheet no. 1,240,727 in the U. S. National Herbarium, in a quite different group of numbers from the sheet of *Tracy 8942* with the printed label, which is no. 513729. The latter is one in a broken series of nearly 300 numbers received from Tracy himself (between no. *7642* and no. *9618*). The sheet of *8946* falls in a much smaller lot including about 70 specimens, which has no accession number, so that its source is not definitely recorded. The lot consists largely of Canadian plants (mostly Compositae) collected by Macoun and Spreadborough, but includes among others 9 Tracy specimens, all numbered in the 8900's. Of 7 of these that I have been able to trace in the herbarium, all 6 besides the *Calyptocarpus* have a mostly handwritten label like that of the *Calyptocarpus* (data in Tracy's hand, name in Greene's). One of them, labeled *Carphephorus corymbosus* in Greene's hand, is actually *Polypteris integrifolia* Nutt., and a duplicate with completely printed label, belonging in the lot of nearly 300 numbers referred to above, bears the same data. In this case, there is no reciprocal specimen of *Carphephorus* labeled as *Polypteris* in the herbarium and it would appear that Greene, in a moment of mental aberration, had actually made this misidentification. It seems reasonably certain that this lot of about 70 specimens was received from Greene himself, perhaps at different times, since there is no lot number.

From all this it would appear that Greene had actually identified no. *8946* as *Calyptocarpus*, although it is *Sanvitalia*. Such a misidentification, although unlikely, is possible, but it seems most improbable that Greene would have misidentified the other component of the pair in a precisely reciprocal way. If a transposition somehow occurred, it seems impossible to determine from the available evidence whether the locality was switched as well. Mrs. Chase tells me that when she looked through the grasses of Tracy's herbarium in 1907, at his invitation, she found the arrangement of the material far from orderly, so that it would be easy to believe that an earlier transposition of numbers or labels might have occurred there. Whatever the truth of this matter, the fact that evidently both *8942* and *8946* were

collected in Texas makes it possible to discard the locality Tensaw, Alabama, attributed to the type of *C. blepharolepis* on its printed label and in the original description. Whether it actually came from Brownsville or from Corpus Christi is uncertain.

Dr. Albert L. Delisle informs me that there is no material of either *Calyptocarpus* or *Sanvitalia* in the E. L. Greene Herbarium at Notre Dame University, and Dr. F. W. Gould writes that the Tracy Herbarium preserved at the Texas A. & M. College at College Station, Texas, does not have a specimen of either of the two Tracy exsiccatae in question.

Aside from the evidence supplied by the Texas locality on the handwritten label of no. *8946*, it is extremely unlikely that either *Sanvitalia ocymoides* or *Calyptocarpus vialis* could have been found in Alabama in 1904. So far as the *Sanvitalia* is concerned, there are at the present time no specimens from east of Texas in the herbaria at Washington, Beltsville, Cambridge, and New York, and I know of no records for it. *Calyptocarpus vialis*, although now known from Texas to Florida, and south into Mexico, does not appear to have begun its eastward march so early. Small (Flora, ed. 1, 1903 and ed. 2, 1913) gave it only from southern Texas, and it is not listed in Mohr's Plant Life of Alabama (1901), in Lowe's Plants of Mississippi (1921), or in any of the local floras of these states and of Louisiana and Florida listed in part 1 of the Geographical Guide to Floras of the World (1942). It is represented in the U. S. National Herbarium from the states east of Texas only by a sheet from New Orleans, La., collected by H. R. Reed in 1927. I collected it myself in waste ground in Audubon State Park in that city in the spring of 1955. In the herbarium of the U. S. National Arboretum are specimens collected by O. M. Freeman in lawns at Miami, Florida, in Jan. 1940 and again in Feb. 1948. In the herbarium of the New York Botanical Garden (data supplied by R. C. Cowan) are specimens from LOUISIANA: Waste lots, New Orleans, 1930, *Small and Alexander*. ALABAMA: Campus of the University, on damp, shaded, wooded hillside, Tuscaloosa, 1951, *Bert C. Williams*. FLORIDA: On edge of lawn, growing in dense mat for about 100 feet, Coral Gables, 11 Jan. 1946, *W. M. Buswell*.

To summarize: It is evident that Dr. Robinson, observing that the material distributed as "*Calytrocarpus tampicanus*" under Tracy's no. *8946* was not that species, proceeded to describe it as new without sufficiently checking the generic characters. It is also quite evident that the specimens of *Sanvitalia ocymoides* on which the new specific name was based were collected in Texas, not in Alabama, but it is not certain whether they came from Brownsville or Corpus Christi. The name *Calyptocarpus blepharolepis* Robinson becomes a synonym of *Sanvitalia ocymoides* DC., and the genus *Calyptocarpus* remains monotypic.—

PLANT INDUSTRY STATION, BELTSVILLE, MD.

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## RANGE EXTENSIONS IN NORTHWESTERN PLANTS

F. J. Hermann

During the late summer of 1955 Bernard M. Leese and the writer were detailed by the Plant Introduction Section, Horticultural Research Branch, U. S. Department of Agriculture to collect seed of native plants in northwestern United States for forage experimentation. A number of the plants collected represent appreciable extensions in range, new state records, etc., which seem to be worth recording. Collection numbers cited in the list are those of the writer. Herbarium abbreviations, taken from Lanjouw's Index Herbariorum (Regnum Vegetabile Vol. 2, Part 1, 1954), are as follows: CA—California Academy of Sciences, San Francisco; Mont—Montana State College, Bozeman; NA—National Arboretum Herbarium, Washington, D. C.; RM—Rocky Mountain Herbarium, Laramie, Wyo.; and US—National Herbarium, Washington, D. C.

### PLANTS NEW TO MONTANA

Muhlenbergia glomerata (Willd.) Trin. Salix-Potentilla bog, 2 miles NE. of Upper Red Rock Lake, Beaverhead Co., Sept. 10 (*12491*, Mont, U. S.).

Carex leptopoda Mack. Springy roadside embankment bordering Thuja woods E. of Lake McDonald, Glacier National Park, Flathead Co., Sept. 4 (*12440*, Mont, NA); boggy edge of streamlet, clearing in larch-hemlock woods, SW. of Hungry Horse Dam, ca. 5 miles SE. of Hungry Horse, Flathead Co., Sept. 6 (*12466*, Mont.). Reported from Glacier National Park by Standley but not recorded from the state by Mackenzie.

JUNCUS COMPRESSUS Jacq. Marshy roadside ditch, 9 miles S. of Wisdom, Beaverhead Co., Sept. 9 (*12484* CA, Mont, NA, US). Apparently not previously reported west of eastern Ontario.

## *Additions to the Flora of Glacier National Park*

The following species are not recorded in Standley's Flora (Contrib. U. S. Nat. Herb. **22:** 235–438. 1921) or in the supplementary reports by Graff (Bull. Torr. Bot. Club **49:** 175–181. 1922), Maguire (Rhodora **36:** 305–308. 1934 and **41:** 504–508. 1939), McLaughlin (Rhodora **37:** 362–365. 1935) and Harvey (Proc. Mont. Acad. Sci. **14:** 23–25. 1954).

ELYMUS INNOVATUS Beal. Moist open bank of Belly River, 3 miles S. of Canadian border, Glacier Co., Sept. 3 (*12432*, Mont, US).

CAREX CUSICKII Mack. Marshy border of pond, end of old logging road No. 20, alt. ca. 3500 ft., Flathead Co., Sept. 5 (*12445*, Mont, NA; *12447*, US).

CAREX MICROPTERA Mack. Low moist edge of log trail through spruce-fir woods, alt. ca. 4900 ft., Piegan Pass Trail ca. ½ mile N. of Gunsight Lake Trail, Glacier Co., Sept. 2 (*12413*, Mont, NA).

CAREX PHYSOCARPA Presl. Marshy clearing in willow thicket, W. shore of Swiftcurrent Lake, alt. 4860 ft., Glacier Co., Aug. 30 (*12368*, Mont, NA). Standley's report of *C. miliaris* Michx. is probably referable to this species.

CAREX STIPATA Muhl. Springy roadside embankment bordering Thuja woods E. of Lake McDonald, Flathead Co., Sept. 4 (*12439*, Mont, NA); edge of Lime Springs Beaver Pond, alt. 3500 ft., S. of Apgar Mts., Flathead Co., Sept. 4 (*12443*, Mont, US).

### PLANTS NEW TO WYOMING

CAREX HETERONEURA W. Boott. Wet mossy border of streamlet in narrow ravine, alt. 8700 ft., W. slope of Mt. Washburne, ca. ½ mile N. of Dunraven Pass, Yellowstone National Park, Sept. 12 (*12535*, NA; *12536* CA, Mont, RM, US). Previously known only from California and western Nevada.

CAREX LEPORINELLA Mack. Dried bed of draw in meadow, Continental Divide, alt. 8300 ft., 4 miles NW. of West Thumb, Yellowstone National Park, Sept. 12 (*12519*, CA, Mont, NA, RM). Recorded only from the Pacific States by Mackenzie; recently reported (Amer. Midl. Nat. **51:** 272. 1954) also from Nevada.

CAREX LIMNOPHILA F. J. Hermann (Leafl. West. Bot. **8:** 28 1956). Gravelly edge of road bordering willows on north shore of Half Moon Lake, alt. ca. 7500 ft., Wind River Range, 7 miles NE. of Pinedale, Sublette County, Aug. 21 (*12252*, CA, NA, RM, US); abrupt mossy shore of Bridge Bay, Yellowstone Lake, alt. ca. 7800 ft., 3 miles SW. of Lake Junction, Yellowstone National Park, Sept. 12 (*12527*, Mont, NA, US). Endemic to Wyoming so far as known.

CAREX PRAECEPTORUM Mack. Willow fringe of Little Bear Creek, alt. ca. 9000 ft., in meadow 2½ miles ENE. of Beartooth Lake, Park

Co., Sept. 13 (*12552*, Mont, NA, RM). Known to Mackenzie only from the Pacific States; recently reported (Amer. Midl. Nat. **51:** 274. 1954) also from Nevada.

Carex stenoptila F. J. Hermann (Leafl. West. Bot. **4:** 194. 1945). Rocky bank of Isa Lake, Craig Pass, alt. 8300 ft. (*12512*, CA, Mont, NA, RM) and dry open lodgepole pine-fir woods, alt. 8700 ft., W. slope of Mt. Washburne ca. ½ mile N. of Dunraven Pass, Yellowstone National Park, Sept. 12 (*12537*, CA, NA, US). Previously known only from Colorado.

Carex substricta (Kükenth.) Mack. Sedge meadow, Fiddler's Lake, Wind River Range, alt. ca. 10,000 ft., 24 miles SW. of Lander, Fremont Co., Aug. 23 (*12280*, NA).

Juncus biglumis L. Edge of cold streamlet on tundra below Beartooth Pass, alt. 10,500 ft., Park Co., Sept. 13 (*12562*, CA, Mont, NA,RM, US). Although Rydberg (Flora of the Rocky Mountains and Adjacent Plains, p. 152. 1922) indicates the range of this arctic-alpine species as "Greenl. —B.C.—Alaska; Eurasia," Buchenau (in Engler, Das Pflanzenreich 4 (36): 223. 1906) cites a collection of Theodore Holm's from Long's Peak, Colorado, and Standley (Contrib. U. S. Nat. Herb. **22:** 307. 1921) reports the plant from Gunsight Pass, Glacier National Park, Mont.

Juncus tracyi Rydb. Dominant on wet open springy slope, edge of Douglas fir-aspen woods, alt. ca. 7000 ft., 5.6 miles W. of Tower Junction, Yellowstone National Park, Sept. 13 (*12541*, CA, Mont, NA, RM, US).

Juncus vaseyi Engelm. Damp crevices on rock shore, head of Half Moon Lake, alt. ca. 7500 ft., Wind River Range, 8 miles NE. of Pinedale, Sublette Co., Aug. 21 (*12262*, NA).

### *Additions to the Flora of Yellowstone National Park*

McDougall and Baggley's "Plants of Yellowstone National Park" (U. S. Govt. Printing Office, Washington, 1936) does not include the following plants.

Carex heteroneura W. Boott. (Data under Wyoming.)

Carex illota Bailey. Boggy edge of Isa Lake, Craig Pass, alt. 8300 ft., Sept. 12 (*12509* NA, RM); meadow, Continental Divide, alt. 8300 ft., 4 miles NW. of West Thumb, Sept. 12 (*12522*, US).

Carex kelloggii W. Boott. Rocky bank of Isa Lake, Craig Pass, alt. 8300 ft., Sept. 12 (*12511*, NA, RM).

Carex leporinella Mack. (Data under Wyoming.)

Carex limnophila F. J. Hermann. (Data under Wyoming.)

Carex microptera Mack. Rocky bank of Isa Lake, Craig Pass, alt. 8300 ft., Sept. 12 (*12510*, NA, RM, US).

Carex neurophora Mack. Wet mossy border of streamlet in narrow ravine, alt. 8700 ft., west slope of Mt. Washburne, ca. ½ mile N. of Dunraven Pass, Sept. 12 (*12534*, NA, RM, US).

Carex stenoptila F. J. Hermann. (Data under Wyoming.)

Carex tolmiei Boott. Meadow, Continental Divide, alt. 8300 ft., 4 miles NW. of West Thumb, Sept. 12 (*12521*, NA, RM).

Juncus hallii Engelm. Plentiful in meadow, Continental Divide, alt. 8300 ft., 4 miles NW. of West Thumb, Sept. 12 (*12520*, NA, RM, US).

JUNCUS TRACYI Rydb. (Data under Wyoming.)

LUZULA PIPERI (Coville) Jones. Abrupt mossy shore of Bridge Bay, Yellowstone Lake, alt. ca. 7800 ft., 3 miles SW. of Lake Junction, Sept. 12 (*12528*, NA).

ASTER LEUCANTHEMIFOLIUS Greene. Open rhyolite slope on Norris Basin-Mammoth Hot Springs Road, alt. ca. 7800 ft., Sept. 11 (*12502*, NA).

### PLANT NEW TO UTAH

THERMOPSIS RHOMBIFOLIA Nutt. Open lodgepole pine forest W. of Sheep Creek Canal, alt. ca. 8500 ft., Uinta Mts., Aug. 14 (*12129*, NA, US).

### *Additions to the Flora of the Uinta Mountains*

Two species not reported in Graham's "Botanical Studies in the Uinta Basin of Utah and Colorado" (Annals Carnegie Mus. (Pittsburgh) vol. 26. 1937) are the following.

AGROPYRON LATIGLUME (Scribn. & Sm.) Rydb. Meadow along Middle Fork of Sheep Creek, atl. 9000 ft., on road to Spirit Lake, Aug. 14 (*12136*, US).

THERMOPSIS RHOMBIFOLIA Nutt. (Data under Utah.)

### NEVADA RANGE EXTENSION

The occurrence of *Trifolium monanthum* A. Gray in eastern Nevada, while not a new record for the State, is a rather notable extension in range since the species has previously been known only in western Nevada. This was collected on the moist bank of a stream in aspen woods, Lamoille Canyon, alt. ca. 7800 ft., Ruby Mts., 7 miles SE. of Lamoille, Elko Co., Aug. 10 (*12087*, NA)—PLANT INDUSTRY STATION, BELTSVILLE, MD.

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## NUTTALL NOT THE AUTHOR OF FRASER'S CATALOGUE

LLOYD H. SHINNERS

NUTTALL in 1818 unequivocally acknowledged only 13 out of 71 new names in Fraser's 1813 Catalogue as his. Ten of the 13 had appeared as *nomina nuda*. Two were placed in synonymy, and two were misquoted (including one of those placed in synonymy). In addition he published as new 10 species listed in the Catalogue without mention of the fact that they had appeared there. He obliquely claimed responsibility for another which he does not cite by name, and for which he adopts Pursh's binomial, though pointing out that Pursh had described a mixture representing two genera (*Astragalus crassicarpus*, called by Nuttall *A. carnosus* Pursh, the discordant element being named *Sophora sericea*

Nuttall). In 1840 (Trans. Amer. Philos. Soc. **7:** 301, in comments under *Dieteria sessilifolia*) he directly claimed responsibility for one or presumably two more ("*Aplopappus spinulosus*, to which I applied the name of *Sideranthus* in Fraser's Catalogue": two species are there listed under this generic name). Two names which had appeared in the Catalogue were credited by Nuttall in 1818 to the Botanical Magazine (*Bartonia decapetala*, there credited to Pursh) and its editor, Sims (*Allium stellatum*, there credited to Ker-Gawler), and a third (*Oenothera macrocarpa*) was credited to Pursh. The implication is that the Catalogue (with 89 names altogether) was prepared by someone who used a small number of Nuttall's names and in addition a much larger number of names coined by other persons. This seemed so obvious that the point was not elaborated in my previous article. It was surprising to read Dr. Graustein's statement that "there is no doubt" that Nuttall authored the Catalogue, and that I had furnished "no convincing evidence" to the contrary. The assertion of Cronquist, Keck and Maguire that "it is universally acknowledged that many or all of the new names contained in it were those of Thomas Nuttall" is untrue, and is an attempt to present hearsay as if it were scientific evidence.

Under English and American common law, a man is judged innocent until proved guilty. The ready assumption that Nuttall authored Fraser's Catalogue is therefore legally unsound. I must protest being put on the defensive when in reality it is the opposition who must prove their case. Instead of uncritically adopting a plausible supposition, we should assemble evidence about it. By a detailed comparison of the Catalogue and the works of Nuttall and Pursh, I obtained what seemed to me adequate evidence for rejecting the thesis that Nuttall wrote the Catalogue. It did not seem adequate to others, and for that reason I am going to the unwelcome trouble of presenting further arguments.

Let me insist again that this is really uncalled for. As a matter of basic law, my side of the case requires no argument until seriously challenged. The burden of first proof rests with the opposition. Let me begin by playing Devil's advocate and summarizing their evidence, since they have not made any effort

to do so. First is the fact that Nuttall wrote "by T. Nuttall" on the Philadelphia copy of the Catalogue. This I have already stated does not have to mean that he claimed to be its author, but can mean instead merely that he claimed to have brought back the plants listed in it, which he unquestionably had. The philosophical Doctrine of Parsimony asks that in propounding a theory, we adopt one that requires the least possible amount of assumption. Stated more pithily, that theory is best which theorizes least. It better accords with this doctrine to uphold the second interpretation, which asks us to assume nothing that is not already known to be true, than it does to uphold the first one, which is wholly supposititious. Further, Nuttall's own later actions are strangely inconsistent with the first interpretation, but not at all with the other. I hold therefore that the first piece of evidence to support the claim of Nuttallian authorship has not proved it. The second piece of evidence is the fact that Nuttall in later publications (chiefly in his Genera, 1818; one item in 1840, mentioned above) claimed responsibility for certain names in the Catalogue. I have already pointed out that he claimed remarkably few of them, and that he specifically credited three of them to other authors. If he was the direct author of the catalogue, why did he ignore most of the names in it, and why did he credit some to persons other than himself? Again I choose the explanation that demands least in the way of gratuitous assumption: that the Catalogue was prepared by someone else who adopted a rather small number of names coined by Nuttall, along with many more which were not. Again, the thesis of Nuttallian authorship is not proved. And let me repeat that what we must first require is that it be proved, not that it be disproved.

Let me extend my role of Devil's advocate by indulging in further suppositions like that of Nuttallian authorship for the Catalogue, but in another direction. I suggest that the 10 names which Nuttall published in 1818 as new, without mentioning that they had appeared in the Catalogue, had not originated with him at all, but were the inventions of someone else; that Nuttall was expropriating them in exactly the same free manner that Sims, Ker-Gawler and Pursh had done before him. Such was the practise of the time! There has been too

much repetition of the theme that Pursh was an exceptional blackguard. Let us see how his contemporaries behaved.

John Sims described *Oenothera missouriensis* with Plate 1592 of Curtis's Botanical Magazine, dated Nov. 1, 1813. Sims states that it was "found by Mr. Nuttall in the neighbourhood of the Missouri," and adds, "We do not find that this species has been before noticed: it seems to differ from every one described by Michaux or by Pursh, whose valuable Flora, speedily to be published, we have been favoured with the opportunity of consulting. . . . Communicated from the Sloane-Square Nursery by Messrs. J. and J. T. Fraser." It was not relayed to Pursh for him to publish in his Flora! In Fraser's Catalogue it appears as *O. macrocarpa* (which name must be adopted if the Catalogue names are considered valid). It was described as new by Pursh under the same name, and by Nuttall in 1818 as his new species *O. alata*, with "*O. macrocarpa* PH." as synonym, but no mention of *O. missouriensis*. In view of Nuttall's several references to the "Bot. Mag.," his disregard of Sims's binomial is very odd, and possibly not wholly "innocent," to borrow from Dr. Graustein's quotation. And how are we to regard his bald rejection of both the original Catalogue name and that of Pursh? John Bellenden Ker, or Ker-Gawler as he styled himself (identified only by the cryptic initial "G."), described *Scilla esculenta* with Plate 1574 of the Botanical Magazine, dated Aug. 1, 1813, citing as synonyms *Phalangium esculentum* "Fraser's Catalogue, &c.," and *Phalangium Quamash* Pursh, "*nondum evulgata*." He says, "We have added the synonym from the work of Mr. Pursh, in consequence of a communication that gentleman was so obliging as to make to us, in which he assured us, that Mr. Fraser's plant, from which our drawing has been made, was of the same species as that he had in view. . . . We have not had the opportunity of seeing the figure in Mr. Pursh's work, which is not yet published. . . . Our drawing was made from a plant imported by Mr. Nuttall, which flowered at Mr. Fraser's Nursery, in Sloane-Square."

Instead of belaboring Pursh so persistently for his treatment of Nuttall, should we not extend our sympathies for the treatment he received from Sims and Ker-Gawler? Perhaps not. They were birds of a feather, and on at least one notorious

occasion joined forces in a deed now regarded as nefarious, but taken more casually then. In publishing *Bartonia decapetala* (Bot. Mag. t. 1487, Aug. 1, 1812), Sims declares, "Living plants have been brought to this country, by Mr. THOMAS NUTTALL, who collected them. . . . It has not however as yet flowered here, on which account our drawing was taken from dried specimens. It is by particular request only that we have been induced to publish such, contrary to our rule, seldome deviated from, and never without mentioning it, of admitting none but drawings from the life. . . . For the above generic and specific characters, and indeed for the whole communication, we are indebted to Mr. FREDERICK PURSH, author of a new Flora of North-American plants, now in the press." Considering the very free and easy practices of the time, it does not seem to me at all unreasonable to think that Nuttall in 1818 sometimes indulged in the same kind of thing. I think it plausible to explain the 10 names lifted from Fraser's Catalogue without acknowledgment as evidence that he did. True, I have no proof of it. But it is just as true that there is no real proof of the contrary.

A point in the above examples calling for particular emphasis is the fact that none of the authors accepted Fraser's Catalogue names as having legal status. Pursh and Nuttall both quote them, sometimes adopting and publishing them as new. Sims and Ker-Gawler regularly quote as inconsequential synonyms names from "Fraser's Catalogue, &c." when describing new species. What is meant by the unexplained abbreviation "&c."? Could there have been other, less renowned nursery lists in which names appeared? Could one or more such have come out ahead of Fraser's? For the benefit of the opposition, I declare that both suppositions are true, and that we must search for still older and unknown authors of the names, and perhaps for additional descriptions for many which were *nomina nuda* in the one catalogue which has come down to us. Fantasy, yes, but surely plausible. In accordance with the practise of the opposition, my thesis is therefore valid, and must be accepted until someone can absolutely disprove it.

Dr. Graustein's assertion that Nuttall did not consider the Catalogue names validly published should dispose of the matter for those who believe that he wrote it. But Cronquist, Keck

and Maguire have put forth an astonishingly incoherent argument for validity of "Nuttall's" names containing the statement that authorship is irrelevant. Their assertion that the names "were accepted in that published work by whoever wrote it" is dogmatic and quite meaningless. As pointed out above, none of the four known botanical authors involved (at least three of whom reportedly coined names used in the Catalogue) accepted those names as legally published. We must look at the case with our present rules of nomenclature in mind. Despite the seemingly scandalous customs of the time, our four early botanists behaved in this case remarkably in keeping with our current views on valid publication and formal acceptance by an author of new names. I see no justification for acting contrary to both early custom and modern rules. It is really supererogation to bring in anonymity as equivalent to non-acceptance in order finally to reject the Catalogue names, but I repeat that this is logical and legitimate. The three contending authors have presented no reason to refuse Rousseau's suggestion. They state flatly in one sentence that "anonymity of the author is no bar, under the Rules, to validity of publication of a name," but add lamely in the same paragraph that they "do not wish to comment on the status" of Rousseau's example, and follow this with the dogmatic statement about the Catalogue (wholly unproved, and refuted by contemporary evidence) which has just been quoted.

Still we have not done with this much belabored subject. If so much in it is controversial, we may well turn to established usage, to glean any help we can. Let us review in detail the names which appeared in Fraser's 1813 Catalogue with enough description to require consideration. Of the twenty, three were validly described by Nuttall in 1818 with the same binomials, were not named by anyone else in the interim, and therefore need not concern us further: *Cactus* (now *Mammillaria*) *viviparus*, *Lilium andinum*, *Rudbeckia purpurea* var. *serotina*. A fourth had an older name: *Vitis campestris* was *V. riparia* Michx. (*V. vulpina* of authors). The two species of *Sideranthus* may be disregarded, since they were given a combined description and were not differentiated. (The generic name may also be rejected as an inextricable mixture, though as Britten pointed out, it should have been adopted under the American Code for

*Chrysopsis* because the first species to be listed when the two were differentiated was in the later-described genus: a case for so doing could even be made out now, if my transfer of *Chrysopsis* to the older *Heterotheca* is no more acceptable than my views on Fraser's Catalogue.) For three species, the only question is one of authorship: *Eriogonum flavum* (published by Pursh, not claimed by Nuttall), *Malva* (now *Sphaeralcea*) *coccinea* (published by Pursh, later claimed by Nuttall), and *Phalangium* (now *Camassia*) *esculentum* (described by Ker-Gawler as *Scilla esculenta*, next by Pursh as *Phalangium Quamash*, then claimed by Nuttall with the original Catalogue name). For the last-named species, Gould unaccountably uses the binomial *Camassia Quamash* (Pursh) Greene in his revision of the genus (Amer. Midl. Nat. 28: 728, 1942). This must give way to *C. esculenta*, with (Nutt.) Lindley as authorities if dated from the Catalogue (very precisely with "J. & J. T. Fraser" in parentheses, as publishing authors), or (Ker-Gawler) Lindley if dated from the Botanical Magazine.

If we reject the Catalogue names, we must abandon *Amorpha nana* Nutt., *Astragalus crassicarpus* Anon. (Nutt.?—he does not actually admit responsibility for this binomial, though obliquely claiming the species was his), *Dalea enneandra* Anon., *Agastache anethiodora* (Anon.) Britton, *Penstemon grandiflorus* Anon., *Ratibida columnifera* (Anon.) Wooton & Standley, and *Yucca glauca* Anon. (Names which were never acknowledged by Nuttall as his are marked "Anon."; they would have to be credited to J. & J. T. Fraser if to anyone.) These would have to be called respectively *Amorpha microphylla* Pursh, *Astragalus carnosus* Pursh emend. Nutt., *Dalea laxiflora* Pursh, *Agastache Foeniculum* (Pursh) Kuntze, *Penstemon Bradburii* Pursh, *Ratibida columnaris* (Pursh) Rafinesque, and *Yucca angustifolia* Pursh. It should be pointed out again that Nuttall himself accepted the second, third, fifth, and sixth of the latter names, in contemporary combinations; that he credited *Penstemon grandiflorus* to "Fras. Cat." and not to himself; that he never mentioned *Hyssopus* (later *Agastache*) *anethiodorus;* and that he claimed only *Amorpha nana* as his.

If we accept the Catalogue names as validly published, we must abandon *Oenothera missouriensis* Sims, *O. caespitosa* Sims,

*Grindelia squarrosa* (Pursh) Dunal, and *Gaillardia aristata* Pursh. These must be called respectively *Oenothera macrocarpa* Nutt. (or J. & J. T. Fraser), *O. cespitosa* Nutt. (or J. & J. T. Fraser), *Grindelia* (new combination based on *Thuraria herbacea* Anon. in J. & J. T. Fraser), and *Gaillardia* (new combination based on *Virgilia grandiflora* Anon. in J. & J. T. Fraser). Under present extremist rules, since publishing authors are held more important, we need cite only the names of the Frasers if we choose, crediting none to either Nuttall or Pursh.

In mentioning only the case of *Penstemon grandiflorus* vs. *P. Bradburii* ("*bradburyi*"), the three New York authors were telling us a great deal less than the whole truth. If their views are accepted, we shall be required to replace three very familiar names of widespread and economically important species (*Oenothera missouriensis*, cultivated; *Grindelia squarrosa*, weed; *Gaillardia aristata*, cultivated) with much more offensive substitutes than *Penstemon Bradburii*, two of them new combinations! How much better to take the course which requires no new names, and the displacement of none that are nearly so common and widely known as the three just cited. (I discount *Astragalus carnosus* and *Dalea laxiflora* because each of these species appears in current works not under one name but under three. No possible course of action can avoid the rejection of names for them which have become well known for some parts of the country.) The three authors claim to "believe that the interests of nomenclatural stability would be better served by the admission of Fraser's Catalogue as a proper publication than by its rejection." I ought to have been utterly crushed by the weight of so much eminent authority. Instead I survive to observe mildly that authority is, after all, an imprecise term.

My earlier conclusions still stand. There is no proof that Nuttall himself wrote Fraser's Catalogue. This was compiled by a person or persons unknown, using some unpublished names coined by Nuttall (possibly even with his assistance in so doing), but using a much larger number of names originated by others. The Catalogue names were not accepted as validly published in it by Nuttall, nor by Pursh, nor by Sims, nor by Ker-Gawler. There is no necessity to accept them today. By rejecting them, we keep name changes to a minimum.

A last additional note on *Astragalus carnosus*. It is known that Pursh himself was describing primarily a specimen of *Sophora sericea*. He added the fruit characters from an *Astragalus* collected by Nuttall, and chose an epithet describing the fruit in particular. The binomial therefore rests on discordant syntypes, regardless of the fact that Pursh may not have had in his hands material of anything but the *Sophora*. Under the rules, the first author to select a lectotype for a species based on a mixture fixes the application of the binomial. This Nuttall did in 1818, by restricting the binomial to the *Astragalus* element. If we reject the Catalogue name (as Nuttall himself did, and as I argue we therefore must do), and do not split up the genus *Astragalus*, the plant must be *Astragalus carnosus* and cannot legally be called anything else. Pursh's primary type material ceased to have any bearing on the application of the binomial when Nuttall explicitly defined it as belonging to an *Astragalus*.

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# SOME ADDITIONS TO THE ORCHID FLORA OF PUERTO RICO

Harold F. Winters and Charles Schweinfurth[1]

The Island of Puerto Rico, the smallest and easternmost of the Greater Antilles, is one of the more thickly populated areas of the world. It has a minimum of undisturbed vegetation and is not particularly rich in orchid species.

The orchids of Puerto Rico have been studied by various well-known taxonomists. Among them are Alfred Cogniaux whose studies were published in conjunction with Ignatius Urban (1903, 1909-10) at the beginning of the century. The collections and writings of Britton and Wilson (1924) comprise the most recent comprehensive taxonomic investigation. Fifty-four genera of orchids with 95 species are reported in their Island flora.

Subsequent exploration by various collectors (Winters, 1949) has brought to light additional orchid species. Some of these are widespread in the West Indies, but have not been reported previously from Puerto Rico. Others are rare in the area. The purpose of this report is to extend the recorded range of the several species to include Puerto Rico. Unless otherwise indicated, the identifications were made by Mr. Charles Schweinfurth.

**Basiphyllaea angustifolia** Schlter. *Winters 88*, collected Oct. 8, 1955, in late flowering and early fruiting stage. Terrestrial in deep leaf mold over serpentine rock. Maricao Insular Forest, at 2,000 feet altitude. Rare. Formerly known only from Prov. of Matanzas, Cuba.

**Cranichis tenuis** Reichb. f. *Winters 10*, collected Nov. 11, 1953. Terrestrial in organic accumulation over rocks. Maricao Insular Forest, on lee (dry) side of mountain toward Sabana Grande, at 2,000 feet altitude. Recorded only from Cuba.

**Epidendrum cochleatum** L. var. **triandrum** Ames. Collected by Rev. Donald Dod along Fish Hatchery Trail, Maricao Insular Forest. Identification by H. F. Winters. Recorded only from southern Florida. See plate 113, Correll, D. S., Native Orchids of North America, 399 pp., illus. Waltham, Mass.

**Epidendrum jamaicense** Lindl. *Winters 17*, collected Sept. 9, 1947, Dec. 17, 1954, epiphytic, Maricao Insular Forest, at 3,000 feet altitude; Nov. 22, 1954, La Mina Recreation Area, Luquillo Mts., at 2100 feet altitude; July 1939, collected by A. G. Kevorkian, Maricao Insular Forest. Also collected by F. H. Sargent No. 355, at El Yunque, on a tree, at 1969 feet altitude, April 10, 1938; and by Claud L. Horn No. 5862, on

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old tree trunks, at 2500 feet altitude, in Maricao Insular Forest, June 1939. Apparently fairly widespread in the West Indies.

**Epidendrum oncidioides** Lindl. var. **gravidum** (Lindl.) A. H. & S. Collected Jan. 9, 1940, by A. G. Kevorkian, Maricao Insular Forest. Recorded from Middle America, from Mexico to Panama and Colombia.

**Epidendrum vincentinum** Lindl. *Winters 38*, collected Nov. 22, 1954, from slope of Mt. Britton, Luquillo Mts., epiphytic on trees and shrubs, 2900 feet altitude. This species is recorded from several of the West Indies, from Costa Rica, and Peru.

**Habenaria strictissima** Reichb. f. var. **odontopetala** (Reichb. f.) L. O. Wms. Collected Nov. 27, 1939, by A. G. Kevorkian, Maricao Insular Forest. This species occurs from Mexico to Costa Rica and in Cuba.

**Lepanthopsis melanantha** (Reichb. f.) Ames. *Winters 48*, collected Dec. 7, 1954, epiphytic along trail to San German from Camp Buena Vista, Maricao Insular Forest, at 3000 feet altitude. Rare. This species has been recorded from Cuba, Santo Domingo, and the west coast of Florida. See plate 99, D. S. Correll, l. c.

**Liparis Saundersiana** Reichb. f. *Winters 86*, collected Sept. 17, 1955, from Las Mesas near Mayaguez, 1100 feet elevation, terrestrial; Oct. 8, 1955, Maricao Insular Forest, at 2000 ft. altitude; Rev. Donald Dod, Oct. 1, 1955, Maricao Insular Forest. Previously recorded only from Jamaica.

**Maxillaria rufescens** Lindl. Collected by Rev. Donald Dod, El Verde area Luquillo Mts.; Maricao Insular Forest, at 2900 feet altitude. A widespread species in Central and South America and in the West Indies.

**Pleurothallis Ghiesbreghtiana** Rich. & Gal. (*P. longissima* Lindl.) *Winters 51*, collected Feb. 22, 1955, saxicolous on exposed mountain ridge, Maricao Insular Forest, at 2500 feet altitude. A species frequent in Middle America and the West Indies.

**Polystachya foliosa** (Hook.) Reichb. f. *Winters 11*, collected Oct. 8, 1955, epiphytic at base of shrubs. Maricao Insular Forest, at 2000 ft. altitude. An extremely variable species extending through the American Tropics.

**Stelis pygmaea** Cogn. *Winters 83*, collected in flower and fruit, July 31, 1955, epiphytic along mountain ridge, El Verde area, Luquillo Mts., at 2800 ft. altitude. A little plant confined to the West Indies.

**Vanilla barbellata** Reichb. f. *Winters 80*, collected July 2, 1955, from several locations in Guanica Forest, terrestrial, with vines clambering over shrubs and trees, sea level to 250 ft. altitude. Identified by Donovan S. Correll. Records of this species are from the Bahamas, Florida, and Cuba. See plate 57, D. S. Correll, l. c.

**Vanilla Dilloniana** Correll. *Winters 79*, collected Nov. 21, 1954, in fruit, hilltop, Cambalache Experimental Forest; June 28, 1955, common on mountain ridges, Maricao Insular Forest, at 2300 ft. altitude. Terrestrial, with vines clambering over shrubs and trees. Identified by Donovan S. Correll. This species is recorded from Florida, Cuba, and Santo Domingo. See plate 58, D. S. Correll, l. c.

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# GROWTH HABITS OF ARABIS PERSTELLATA

E. Lucy Braun

Since describing *Arabis perstellata* in 1940 (Rhodora **42:** 47–48), I have had plants of this species almost continuously under observation, noting growth habit year by year. In the eighth edition of Gray's Manual (Fernald, 1950), this and what was known as *Arabis dentata* T. & G. are included in one species, *A. perstellata* E. L. Br., made up of the "typical" variety and var. *Shortii* Fern. (*A. dentata* (Torr.) T. & G.). In the New Britton and Brown Illustrated Flora (Gleason, 1952), these are maintained as distinct but related species, *A. perstellata* Braun and *A. Shortii* (Fern.) Gl. Neither manual adequately states the habit of growth of *A. perstellata*, the former stating "perennial, with strong branching base and definitely perennial leafy basal offsets"; the latter, with no statement, figures a single erect stem arising terminally from an ill-defined basal rosette.

Flowering plants may have from one to thirty flowering stems, *all* axillary; the central axis of the plants is a short leafy stem, very short at first, later elongating 1–3 cm. a year, with leaves more closely placed toward apex (Figs. 1, 2). This central or vegetative axis persists throughout the life of the plant. The first spring, the plant (from seed germinating sometime during the previous summer or fall) is a loose rosette of petioled leaves (Fig. 3). The central axis elongates, and by the second spring is 1–2 cm. long, the shriveled petioles of leaves of the previous season persisting near its base (Fig. 4). If flowers are produced the second spring, the flowering stem is definitely lateral, from the axil of a leaf of the previous season (Fig. 2). Year by year, henceforth, the central or vegetative axis elongates, and each

FIGS. 1–9. *Arabis perstellata.* FIG. 1. Plant at least 5 years old, showing central vegetative axis and three flowering branches of 1954 growth; below, at successively older nodes, stubs of flowering branches of previous years, and, at 1951 node, part of the stem of a vegetative offset. FIG. 2. A two-year old plant, with central vegetative axis and one flowering branch, and at *a*, shriveled petioles of leaves of the previous year. FIG. 3. Rosette in late May of first spring, wrinkled cotyledons at *a*. FIG. 4. Rosette in late May of second spring, with wrinkled petioles (*a*) of previous year. FIG. 1–4 ca. ½ nat. size. FIG. 5. Flower, enlarged. FIG. 6. Silique and wingless seed, enlarged. FIG. 7. Stellate and simple hairs of upper leaf surface. FIG. 8. Stellate hairs of lower leaf surface. FIG. 9. Greatly enlarged scale-like hair.

year flowering stems arise from nodes of the year-old part of the stem. The old stem becomes hard and woody, and the bases of fruiting branches persist for several years, a group for each year of growth (Fig. 1). Occasionally, a vegetative axillary branch is formed (as at the 1951 node in Fig. 1), and henceforth elongates slowly as does the main axis. Very often, the old vegetative axis is decumbent and covered by an accumulation of humus, only the year-old leafy stem arising vertically above the ground surface.

*Arabis perstellata*, then, is definitely perennial by a slowly elongating central axis; axillary offsets occasionally arise; all flowering stems are lateral, and arise near the apparent base of the plant, i. e., from the year-old part of the stem.

Examination of herbarium specimens of the "chiefly biennial" *A. Shortii* suggests that the growth habit may be similar, and that at least some plants may live for more than two years.

*A. perstellata* differs from *A. Shortii* in being densely stellate-pubescent throughout, so densely that stems and foliage are whitish to grayish-green. Forked hairs of the calyx and pedicels (Fig. 5) are long and ascending; those of the silique (Fig. 6) very small and inconspicuous (similar to those that may be present on *A. Shortii*). Long stiff ascending hairs (like those of the upper leaf surface of *A. Shortii*) are scattered among the more numerous stellate hairs of the upper leaf surface (Fig. 7). The lower leaf surface (Fig. 8) and basal parts of stems are whitened with closely placed and interlocking stellate hairs. Occasional much larger scale-like hairs, with papillate arms, occur on the lower leaf surface (Fig. 9). Pedicels of *A. perstellata* at anthesis are nearly twice as long as the flower (those of *A. Shortii* about one-half as long) and later elongate to 10 mm.; petals are pink (instead of yellowish-white), 3–4 mm. long and half again as long as the sepals (instead of 2–3 mm. long and barely exceeding the sepals). Cauline leaves of *A. perstellata* are more deeply and irregularly toothed than those of *A. Shortii*, auricled or clasping on the middle and upper parts of the branches, tapering toward the base or slender-petioled and lyrate-pinnatifid on the lower part of branches; at least some of the leaves of the vegetative axis lyrate-pinnatifid, all slender-petioled.

The two taxa are evidently closely related, but apparently distinct species. *A. perstellata* is very abundant at and near the

type locality—wooded calcareous bluffs of Elkhorn Creek, Franklin County, Kentucky, in the Bluegrass region of that state.—UNIVERSITY OF CINCINNATI.

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# A CTYOTAXONOMIC STUDY OF THE GENUS HYMENOPAPPUS (COMPOS.TAE)

BILLIE L. TURNER

(*Continued from page 269*)

## 9a. **Hymenopappus scabiosaeus** L'Hér. var. **scabiosaeus**

*Hymenopappus scabiosaeus* L'Hér. Hymenop. **1:** 1788. *Rothia caroliniensis* Lam. Jour. Hist. Nat. **1:** 17. 1792. *Hymenopappus caroliniensis* Porter, Mem. Torr. Bot. Club **5:** 338. 1894. Photograph of type examined (GH): without date, sheet from Lamarck's herbarium.

*Hymenopappus laxiflorus* L'Hér. in DC. Prodr. **5:** 658. 1836, as synonym.

Plants biennial, 40–150 cm. tall, the stems single from each tap-root, erect, much-branched, angled and grooved, glabrous to sparsely pubescent; leaves alternate, mostly glabrous above and variously pubescent beneath, in the first year simple or mostly once-pinnate, up to 25 cm. long, 4–5 cm. wide, forming a basal rosette; later formed stem-leaves mostly glabrous, 15–50 in number, not much reduced, once-pinnate to bipinnately dissected, with broad to narrowly linear segments; heads numerous, discoid, 25–80-flowered, on densely strigose or glabrate ultimate peduncles mostly 1 to 5 cm. long, these having at their bases conspicuous, membranous, petaloid bracts 5–14 mm. long, 3–10 mm. wide (rarely much reduced); involucral bracts white, petaloid, showy, equal or subequal, 7–15 mm. long, 4–8 mm. wide, membranous for half or more of their length; corollas white or creamy white, sweet scented, 3–5.5 mm. long, the tube stipitate-glandular, 2–3 mm. long, the throat funnelform, 1.2–3 mm. long, with lobes reflexed, about equaling the lobes; achenes obpyramidal, 4-sided, 3.5–5 mm. long, short-pubescent, principally on the corners, with hairs 0.1–0.4 mm. long, the faces with 2–3 nerves; pappus of 14–18 small obovate scales 0.1–0.6 mm. long; anthers completely exserted, 2–2.5 mm. long; chromosome number not known.

DISTRIBUTION.—Scattered, apparently rare, principally in the Mississippi Valley region and southeastern United States: known by relatively few collections from Indiana, Illinois, Missouri, Oklahoma, Arkansas, and eastern Mississippi, Georgia, adjacent South Carolina, and Florida. In the southern part of its range it is commonly found in sandy pine woods; in the northern part it occupies rocky, sandy barrens and open disturbed areas (Fig. 45). April–June.

*Hymenopappus scabiosaeus* var. *scabiosaeus* is difficult to characterize because of the inadequacy of herbarium material from the states outside of Florida. Taken throughout its range the variety demonstrates considerable variability. In eastern Oklahoma and western Arkansas the taxon has races with more pinnately dissected, glabrate leaves than are typical for the variety in South Carolina and Florida. Likewise, the races in Illinois and Indiana tend to be distinguished by extremely large, ovate peduncular bracts. To apply formal nomenclature to these races would be unjustified on present-day evidence, since these same characters may reoccur (with much less frequency) in material from the Southeastern States. In addition, this regional variability is complicated by the seemingly complete intergradation of var. *scabiosaeus* with var. *corymbosus* at their area of contact in eastern Oklahoma and Kansas. Typical *Hymenopappus scabiosaeus* var. *scabiosaeus* can be distinguished from var. *corymbosus* by the key characters listed. In this region, however, clearly intermediate specimens are found. This rather complete intergradation between the two taxa, combined with their close, overall resemblance has been the principal reason for the reduction of *H. corymbosus* to varietal rank.

Early in the course of this study the author was inclined to treat *Hymenopappus scabiosaeus* in a broad sense, including within this species all the funnelform-throated, biennial taxa of the genus. Such a treatment, although perhaps justifiable on purely morphological grounds, would ignore the physiological, genetical, and ecological isolation of some included members. When such isolational barriers can be demonstrated or inferred, even when the morphological characters are somewhat intermediate between the specific and infraspecific level (as in *H. artemisiaefolius*), these other factors should be considered in drawing taxonomic lines. For this reason *H. scabiosaeus* and *H. artemisiaefolius* have been treated as two specific taxa instead of included together under one.

Representative Specimens.—**Arkansas.** benton co.: Along R.R., Sulphur Springs, *E. J. Palmer 2938* (mo). carroll co.: Beaver, *E. J. Palmer 5586* (mo, pom, us). **Florida.** alachua co.: 10 mi. W. of Gainesville, *Blanton 6398* (pom). jackson co.: near Marianna, *Curtiss 6806* (gh, mo, ny, uc). leon co.: near Tallahassee, Apr. 1843, *Rugel* (mo,

NY). MARION CO.: E. of Flemington, *Moldenke 1084* (MO, NY, US). MARTIN CO.: dry place, May 2, 1941, *P. O. Schallert* (NY, UC). SUWANEE CO.: (w/o locality), June–July, 1898, *A. S. Hitchcock* (MO). WAKULLA CO.: Sopchoppy, *F. H. Sargent 6095* (SMU). **Georgia.** JENKINS CO.: dry sandy soil near Millen, *R. M. Harper 762* (GH, MO, NY, US). **Illinois.** CASS CO.: Beardstown, July, 1842, *C. A. Geyer* (GH, MO). KANKAKEE CO.: along R. R., St. Anne, *G. N. Jones 17280* (MO). MASON CO.: sandy barrens and prairie, June 18, 1845, *S. B. Mead* (GH, NY). **Indiana.** STARKE CO.: "frequent in three dry sandy fallow fields," 3 mi. N. and 1.5 mi. E. of North Judson, *Deam 49006* (GH). **Mississippi.** LOWDENS CO.: Columbus, *S. M. Tracey 1400* (GH, MO, US). **Missouri.** BARRY CO.: Eagle Rock, *B. F. Bush 104* (GH, MO, US). MISSISSIPPI CO.: cemetery 2 mi. W. of Charleston, *Steyermark 10259* (MO). SCOTT CO.: sandy open places, May 20, 1895 (1894), *H. Eggert* (GH, MO). STONE CO.: Baxter, *Bush 15587* (MO). **Oklahoma.** CHEROKEE CO.: 20 mi. N. E. of Tahlequah, *N. T. Knodos 71* (SMU). LE FLORE CO.: Pine Valley, *Goodman 2537* (GH, MO, NY, POM, RM). MAYES CO.: 2 mi. N. of Locust Grove, *Stratton 3718* (CAS). MCCURTAIN CO.: Bethel, dry pine hills, *Demaree 12691* (MO, NY). **South Carolina.** AIKEN CO.: Aiken, May 1869, *W. M. Canby* (DS, GH, MO, NY, US).

9b. **Hymenopappus scabiosaeus** var. **corymbosus** (T. & G.), comb. nov.

*Hymenopappus corymbosus* T. &. G. Fl. N. Amer. **2:** 372. 1842. *Rothia corymbosa* O. Ktze. Rev. Gen. **1:** 361. 1891. Type examined (NY): "Arkans., Leavenworth." Probably collected in what is now present-day Oklahoma. (For an outline of Leavenworth's activities in this region, see McVaugh, 1947.)

*Hymenopappus engelmannianus* Kunth, Ind. Sem. Hort. Berol. 15. 1848. Ann. Sci. Nat., Series 3, **11:** 229, 1849. The plant from which this description was taken was grown from seed that had been collected in Texas and sent to Kunth by Engelmann. In the United States National Herbarium there is a sheet of a Lindheimer collection (Fasc. III. Texas. Comal Co.: New Braunfels along Guadalupe R., April. May, 1846, *Lindheimer 438*) which has the name *H. Engelmannianus* written in by hand on the original label. It is likely that this specimen represents a collection of the plant from which the seed was taken, Lindheimer being an "intimate friend" and botanical correspondent of Engelmann (Geiser, 1948, p. 137). The original description is undoubtedly that of *H. scabiosaeus* var. *corymbosus*.

*Hymenopappus sulphureus* Rydb. in Britton, Man. 1007. 1901. Type examined (NY): Kansas. Riley Co.: "Stoney hills," May 23, 1895 *J. B. Norton 285*.

Plants biennial, 40–100 cm. high, the stems single from each tap-root (rarely two crowns forming, especially on injured plants), erect, usually much branched, angled and grooved, tomentose to nearly glabrate; leaves alternate, forming the first year a basal rosette, the primary leaves entire to variously lobed, the later formed rosette leaves becoming pin-

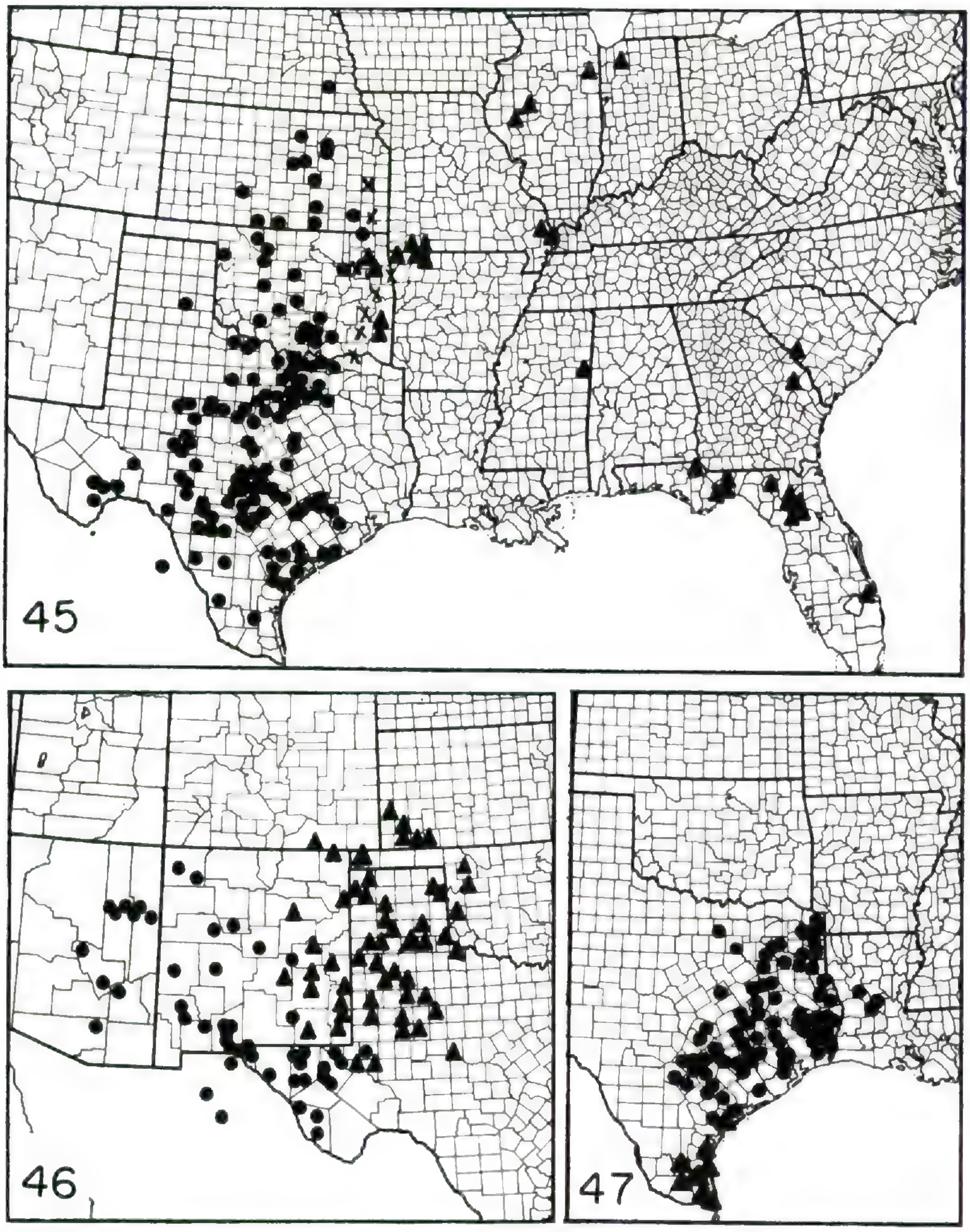


Fig. 45–47. Distribution of *Hymenopappus* species. Fig. 45. *Hymenopappus scabiosaeus* var. *scabiosaeus* (triangles); *H. s. corymbosus* (disks); intermediate specimens (×). Fig. 46. *H. flavescens* var. *flavescens* (triangles); *H. f. cano-tomentosus* (disks). Fig. 47. *H. artemisiaefolius* var. *artemisiaefolius* (disks); *H. a. riograndensis* (triangles).

nately dissected, 5–15 cm. long, 5–7 cm. wide, mostly glabrate or sparsely canescent above, more tomentose below, the ultimate divisions linear, acute, 2–8 mm. wide; stem leaves (on well developed plants) 15–30, becoming reduced upward; heads campanulate, numerous (40–100), discoid, 20–60-flowered, on densely strigose ultimate peduncles 0.5–3

cm. long, these without conspicuous petaloid bracts at their bases, involucre campanulate, principal bracts 5–9 mm. long, 2–4 mm. wide, glabrate above, pubescent below, yellowish-white or white membranous for 2–4 mm. from the acute to narrowly obtuse tip; corollas white or creamy white, 3–4 mm. long, sweet scented, the tube sparsely glandular, 2–3 mm. long, the throat funnelform 1–1.5 mm. long, with lobes reflexed, the lobes equal to or nearly as long as the throat; achenes obpyramidal, 4-sided, 3–4 mm. long, short-pubescent (especially on the corners) with hairs 0.1–0.5 mm. long, the achene faces 2–3-nerved; pappus of 14–18 obtuse or spatulate scales, 0.2–0.8(–1) mm. long; anthers completely exserted, 1.6–2.5 mm. long; $n = 17$.

Distribution.—Open prairies in heavy, calcareous soils and on limestone outcrops from southern Nebraska, central Kansas, Oklahoma to southern Texas and adjacent Mexico (Fig. 45). Late March–July.

The variety is well marked throughout the greater portion of its range, but where it comes in contact with the closely related var. *scabiosaeus* in eastern Oklahoma and Kansas there is complete intergradation between the two taxa (intermediate specimens are designated by x on the distribution map). Typical var. *corymbosus* may be distinguished from var. *scabiosaeus* by its short, narrow involucral bracts, and by its ebracteate peduncles. Typical var. *scabiosaeus* has long, broad involucral bracts, and conspicuous white, membranous peduncular bracts. Likewise, in western Texas, where var. *corymbosus* comes in contact with the yellow-flowered *H. flavescens* var. *flavescens* there appears to be considerable intergradation of their characters, especially as regards leaf- and corolla-shape, perhaps indicating considerable hybridization and introgression in the past between these species. (For implications of such hybridization see discussion under *H. flavescens* var. *flavescens*.) Evidence of present-day hybridization between these two taxa has been found only in a few specimens from Tom Green Co., Texas (*Havard 22*), where their ranges overlap. *H. scabiosaeus* var. *corymbosus* and *H. flavescens* var. *flavescens* are kept genetically separate, for the most part, at their regions of overlap, by distinct seasonal differences in principal flowering times, the former reaching its peak 3–4 weeks before the latter (Fig. 44).

In Texas, the distribution of *H. scabiosaeus* var. *corymbosus* is especially interesting. It is found almost exclusively on heavy clay prairies, its range stopping abruptly at the margins of the

sandy soils of pine and post oak woods.[12] *H. artemisiaefolius* var *artemisiaefolius* occupies these latter habitats. In spite of their extensive region of apparent contact, there is little evidence of intergradation, hybridization or introgression between the two taxa, there presumably being almost complete ecological isolation (possible exceptions discussed below). Lindheimer, an early botanical explorer in Texas, was probably the first to note the ecological distinction between these species, noting in 1846 on a field label of one of his collections the following (*Lindheimer 438:* GH):

*Hymenopappus corymbosus*

In patches on Prairies and margin of wood in fertile rather heavy soil (*H. artemisiaefolius* in sandy soil)
$\frac{4.5}{4.6}$ F. L. n. Br.

In the Rio Grande Valley of Texas *H. scabiosaeus* var. *corymbosus* becomes quite variable as regards several characters, possibly the result of contamination from *H. artemisiaefolius* var. *artemisiaefolius* or its var. *riograndensis*. This area of Texas may prove to hold the answer to some of the evolutionary problems of the *H. artemisiaefolius—H. scabiosaeus* complex. The lack of herbarium material from this region has made the task of evaluating variability of the represented taxa impossible, but it seems clear that the area occupies a critical position as concerns the origin, migration, and subsequent evolution of the funnelform-throated *Hymenopappi*.

A peculiar group of specimens from the Gulf Coastal Prairies in Matagorda and Ft. Bend counties, Texas (*Fisher s.n.; Palmer 9668; Fisher 40093*), perhaps points to the existence of yet another closely related variety within the *H. scabiosaeus* complex. These specimens are like var. *corymbosus* except for their dwarfish, scapose habit (scarcely exceeding 30 cm. in height). However, in light of our present knowledge, it seems best to consider these specimens as representatives of a rather distinct race of

[12] One must be familiar with the peculiar long-distance interfingering of prairie with pine and oak woodland in south-central Texas to appreciate fully this ecological isolation. Dots, which seem on the map to be included in the range of *H. artemisiaefolius* var. *artemisiaefolius*, are, in actuality, on well defined prairie strips within this region.

the variety, at least until further field and variability studies are made on the populations represented in this area.

REPRESENTATIVE SPECIMENS.—**Kansas.** ANDERSON CO.: 1.5 mi. N. of Welda, *R. L. McGregor 4277* (GH)*[13] BARBER CO.: 6 mi. W. of Hardtner, *Rydberg & Imler 626* (NY). BUTLER CO.: August, *S. F. Poole 1302* (US). CLOUD CO.: Miltonvale, *Benke 5181* (GH). COWLEY CO.: (w/o locality), May, 1898, *M. White* (MO). DICKINSON CO.: Solomon, *Benke 4313* (US). EDWARDS CO.: prairies, *A. Finch 136* (MO). GEARY CO.: Ft. Riley, *E. E. Gayle 469* (NY). HARPER CO.: 2 mi. W. of Athony, *Rydberg & Imler 611* (NY). LABETTE CO.: Oswego, bluffs 4 mi. W. of town, *Rydberg & Imler 326* (MO, NY).* MARION CO.: Florence, June 18, 1885, *Pringle* (GH). RILEY CO.: Stony hills, *J. B. Norton 285* (GH, MO, NY, RM, US). SALINE CO.: 6 mi. N. of Salina, *Hancin 2162* (NY). WILSON CO.: 6 mi. S. W. of Neodesha, *W. H. Horr E526* (RM, SMU, US, WS). **Nebraska.** LANCASTER CO.: Lincoln, Aug. 26, 1896, *G. G. Hedgcock* (MO). **Oklahoma.** ADAIR CO.: Westville, May 19, 1921, *Ensign* (NY).* ATOKA CO.: 8 mi. S. of Atoka, *M. Hopkins & A. & R. Nelson 1073* (MO, RM). BLAINE CO.: near Longdale, *G. W. Stevens 831* (GH). CADDO CO.: 3 mi. E. of Hydro, *Hubricht, Shoop, & Heinze B1387* (MO). CARTER CO.: S. of Turner Falls, *Demaree 12298* (MO, NY, UC, US). CLEVELAND CO.: Norman, *W. H. Emig 493* (MO, US). COMANCHE CO.: Fort Sill, *J. Clemens 11843* (CAS, GH, MO, RM). ELLIS CO.: near Shattuck, *Clifton 3452* (GH, MO, NY). GRADY CO.: on False Washita between Fort Cobb and Fort Arbuckle, 1868, *E. Palmer 447* (NY, US). JOHNSTON CO.: Tishomingo, *Cory 58892* (SMU). LATIMER CO.: Limestone Gap, June, 1875, *G. D. Butler* (GH, MO).* LOGAN CO.: Guthrie, *G. W. Stevens 3224* (GH). MAJOR CO.: near Cleo, *G. W. Stevens 786* (DS, GH, MO). MURRAY CO.: Platt Nat'l. Park, *Demaree 12230* (MO, NY, UC). PONTOTOC CO.: S. of Ada, near city limits, *G. T. Robbins 2483* (SMU, UC). PUSHMATAHA CO.: near Finley, *E. J. Palmer 39397* (GH).* ROGERS CO.: Catoosa, *B. F. Bush 1140* (MO, NY).* TULSA CO.: R. R. near Tulsa, May 10, 1940, *H. A. Hawk* (MO). WOODS CO.: near Alva, May 22, 1913 (*G. S. Stevens 547* (DS, MO, NY, US). **Texas.** ARKANSAS CO.: W. of Tivoli on coastal prairie, *Whitehouse 12075* (SMU). BEE CO.: Beeville, *M. E. Jones 29436* (POM). BELL CO.: near Temple, *S. E. Wolff 503* (US). BEXAR CO.: 4 mi. N. W. of San Antonio, *M. Clara 650* (CAS, POM, UC). BLANCO CO.: between Johnson City and Marble Falls, *C. L. & A. A. Lundell 14544* (SMU, US). BREWSTER CO.: 38 mi. S. of Marathon, *Ferris & Duncan 2832* (CAS, DS). BROOKS CO.: roadside, *Clover 823* (NY). BURNET CO.: 10 mi. S. E. of Marble Falls, Rd. to Bee Caves, *L. H. Shinners 7239* (SMU). CALLAHAN CO.: Clyde, *E. J. Palmer 13683* (MO). COLLINS CO.: 2 mi. S. of McKinney, *Timmons 436* (NY). COMAL CO.: New Braunfels, *Lindheimer 929* (GH, MO, NY, SMU, UC, US). COOKE CO.: 7 mi. N. of Gainesville, *Cory 56131* (SMU). DALLAS CO.: rocky prairies near Dallas, *Reverchon 1508* (GH, MO, NY, US). DENTON CO.:

[13] Specimens intermediate toward var. *scabiosaeus* are indicated by an asterisk (*); these are shown on the distribution map (Fig. 45) with an "x."

2.5 mi. S. of Sanger, *Cory 53240* (SMU). EDWARDS CO.: Ranch Expt. Station, *Cory 19029* (GH). ERATH CO.: 8 mi. N. E. of Stephenville, *F. W. Gould 5666* (SMU). FANNIN CO.: Bonham, May, 1896, *J. M. Milligan* (US). FORT BEND CO.: Richmond, *G. L. Fisher 40093* (CAS, US). GILLESPIE CO.: 1 mi. E. of Willow City, *Cory 53625* (SMU). GOLIAD CO.: prairies N. of Goliad, Apr. 8–9, 1900, *H. Eggert* (MO). GRAYSON CO.: 1.7 mi. N. of Collinsville, *Shinners 12402* (SMU). KARNES CO.: 6 mi. N. of Tulsita, *J. F. Hennen 605* (SMU). KAUFMAN CO.: 2 mi. E. of Terrell, *Shinners 10101* (SMU). KERR CO.: Kerrville, *A. A. Heller 1638* (GH, MO, NY, UC, US, WS). LAMAR CO.: Arthur City, along Red R., R. R. embankment, *Cory 56076* (SMU, US).* LASALLE CO.: sands, Cotulla, Apr. 29, 1905, *J. Reverchon* (SMU). LLANO CO.: near Llano, *S. E. Wolff 1586* (US). MCLENNAN CO.: gravel pit, mouth of White Rock Cr., *L. D. Smith 392* (US). MATAGORDA CO.: Bay City, *E. J. Palmer 9668* (DS, MO, US). MEDINA CO.: 1 mi. W. of D'Hanis, *Shinners 7301* (SMU). MILLS CO.: 6.5 mi. S. of Goldthwaite, *Cory 13081* (GH). MITCHELL CO.: red-bed slopes above Lake Hollywood, *Pohl 4745* (SMU). MONTAGUE CO.: W. of Nocona, highway 82, *Whitehouse 15050* (SMU). NOLAN CO.: Eagle Cr., Blackwell, *Studhalter 1198* (US). PALO PINTO CO.: vicinity of Mineral Wells, *Gillespie 5220* (DS, US). PARKER CO.: Weatherford, *Tracy 8544* (GH, MO, NY, US). PECOS CO.: 7 mi. N. of Iraan, cut-off from highway 290, near Sheffield, *Warnock & Turner 807* (SMU). REAL CO.: 29 mi. E. of Rocksprings, *Shinners 7338* (SMU). SAN PATRICIO CO.: near Mathis, *McKelvey 1711* (GH, POM). SOMERVELL CO.: 5 mi. W S. W. of Glen Rose, *Shinners 10072* (SMU). SUTTON CO.: Sonora Expt. Station, *Eggleston 16700* (NY). TARRANT CO.: Polytechnic, *Ruth 301* (MO, RM, US). TAYLOR CO.: 2 mi. W. of Buffalo Gap, *Tolstead 7036* (MO, UC). TERRELL CO.: 7 mi. E. of Longfellow, along highway 90, *Warnock & Turner 592* (SMU). THROCKMORTON CO.: 11 mi. N. of Throckmorton, *Cory 37257* (GH). TOM GREEN CO.: Knickerbocker Ranche, Dove Cr., *Tweedy 316* (US). TRAVIS CO.: Austin, *Tharp* (CAS, MO, SMU, UC). UVALDE CO.: W. of Uvalde, *M. E. Jones 28164* (DS, POM, UC). VAL VERDE CO.: N. of Del Rio, *M. E. Jones 28165* (DS, POM, UC). VICTORIA CO.: Victoria, *Tracy 9048* (GH, MO, NY, US). WALLER CO.: dry prairies, Hempstead, *E. Hall 357*, in part (GH, POM, US). WASHINGTON CO.: (w/o locality), April 21, 1939, *E. Brackett* (GH). WEBB CO.: E. of Laredo, *A. C. Martin 102* (US). WICHITA Co.: 1.6 mi. W. of Electra, *Whitehouse 9775* (US). WILBARGER CO.: 16.9 mi. W. of Electra, Waggoner pastures, *Whitehouse 9845* (SMU). WISE CO.: 2 mi. W. S. W. of Chico, *Shinners 1232* (SMU).

MEXICO. **Coahuila.** Municipio de Muzquiz, hacienda La Rosita, June 26, 1936, *Wynd & Mueller 294* (GH, MO, NY, US).

### 10a. **Hymenopappus artemisiaefolius** DC. var. **artemisiaefolius**

*Hymenopappus artemisiaefolius* DC. Prod. **5:** 658. 1836. *Rothia artemisiafolia* O. Ktze. Rev. Gen. **1:** 361. 1891. Photograph of type examined (US): "Texas, fl. sordide albi, 1832, *M. Berlandier 1532.*" Type in the Delessert Herbarium.

Plants biennial, 40–90 cm. high, tomentose to nearly glabrate; larger rosette leaves, 8–18 cm. long, simple to once-pinnate with broad primary divisions, 6–30 mm. wide, mostly densely tomentose on the lower surface, becoming glabrate above; stem leaves (6–)8–16, not much reduced upward; heads 30–60 per stem, campanulate, on ultimate peduncles 1–4(–6) cm. long; principal involucral bracts broadly elliptic to ovate, 6–12 mm. long, 3–7 mm. wide, snowy-white-membranous for about ½ their length or more (often tinged with red); corollas rosy-vinaceous to rarely completely white, 3.5–5 mm. long, the tube moderately glandular, 2.5–3 mm. long, the throat funnelform 1–1.5 mm. long, with lobes reflexed, as long as, or 1.5 times longer than the lobes; achenes obpyramidal, 4-sided, 3.5–4 mm. long, principally pubescent on the corners with short white hairs 0.3–0.6 mm. long, the faces 2–3-nerved; pappus of 16–18 oblong scales 0.5–1(–1.5) mm. long; anthers completely exserted, 2–2.5 mm. long; chromosome number $n = 17$.

Distribution.—Confined to the sandy pine and post-oak woods of eastern Texas and adjacent Louisiana (Fig. 47). March–May.

The closest relationship of this species is undoubtedly with the *Hymenopappus scabiosaeus* complex (probably var. *scabiosaeus*). It is not treated as a variety of that species because it is morphologically distinct throughout its range and apparently does not intergrade or hybridize with peripheral taxa (except possibly on a local scale with *H. scabiosaeus* var. *corymbosus* and to a limited degree with its own var. *riograndensis* in southern Texas). This treatment is justifiable on morphological, ecological, genetical, as well as practical grounds. Although the taxon is in apparent close contact with *H. scabiosaeus* var. *corymbosus* over at least 1000 miles (linearly along the peripheral area), along this entire line of contact the two taxa remain distinct, apparently as a result of edaphic isolation. *H. scabiosaeus* var. *corymbosus* occurs principally in heavy, clay soils while *H. artemisiaefolius*, as mentioned above, occurs principally in sandy soils. (For further information see discussion under *H. scabiosaeus* var. *corymbosus*.)

*H. artemisiaefolius* var. *artemisiaefolius* intergrades to a large extent with *H. a. riograndensis*, of southern Texas. This is reflected in the tendency toward a larger pappus, less membranous involucral tips, and fewer-leaved stems as one approaches this region from the north.

*H. artemisiaefolius* var. *riograndensis* could possibly represent the progenitor of this whole eastern complex (see discussion under that variety). Future field work should do much to

clarify the limits of the three related taxa of this area: *H. artemisiaefolius* var. *artemisiaefolius*, *H. artemisiaefolius* var. *riograndensis*, and *H. scabiosaeus* var. *corymbosus*.

Representative specimens.—**Louisiana.** natchitoches parish: Chopin, *E. J. Palmer 7328* (cas, mo, ny, us). rapides parish: Alexandria, Aug., 1840, *Hale* (ny). **Texas.** anderson co.: Palestine, Apr. 14, 1929, *Tharp* (ny). austin co.: Mills Cr., 16 mi. W. of San Felipe, Mar., 1844, *Lindheimer 107 (46)* (gh, mo, smu, uc, us). bastrop co.: Bastrop, Apr. 4, 1939, *Tharp* (ny, ws). bexar co.: San Antonio, *E. H. Wilkinson 110* (mo). bowie co.: pine woods N. of Texarkana, June 12, 1898, *Eggert* (mo, ny). brazos co.: College Station, Apr. 28, 1927, *H. B. Parks* (rsa). burleson co.: 7 mi. S. E. of Caldwell, *Gould & Celerier 5447* (smu, uc). caldwell co.: 6 mi. S. E. of Luling, *Cory 48875* (smu). cass co.: Bivins, May 12, 1941, *O. McGinnis* (cas, gh, mo, smu, uc). colorado co.: Columbus, June 11, 1910, *H. H. Rusby* (ny). comal co.: New Braunfels *Dapprich 6740* (smu). dallas co.: sands, Dallas, *J. Reverchon 527* (us). denton co.: 7 mi. N. E. of Roanoke, *Whitehouse 15979* (smu). dewitt co.: Cuero, *Bray 136* (us). fayette co.: Colony, (8 mi. N. of Flatonia), *E. W. Crawford 31* (us). freestone co.: 12 mi. S. of Fairfield, *Shinners 7108* (smu, ws). gonzales co.: Ottine, *Tharp 44472A* (rsa). guadalupe co.: swampy roadside between Luling and Seguin, *M. C. Metz 3066* (ny). hardin co.: Fletcher, *E. J. Palmer 9541* (ds, mo, us). harris co.: Houston, *Bush 35* (gh, mo, ny). harrison co.: Marshall, *E. J. Palmer 5318* (mo, pom, us). henderson co.: 14.6 mi. S. of Athens, *Hennen 274* (smu). houston co.: Grapeland, *Tharp 926* (gh, us). jasper co.: S. of Jasper, *C. L. & A. A. Lundell 11200* (smu). jefferson co.: Port Arthur (&) Beaumont, May 15, 1927, *I. Kolthoff* (us). leon co.: Normange, *Fisher 41269* (cas, us). mclennan co.: Waco, *L. Pace 96* (mo). marion co.: Jefferson, *B. B. Harris 459* (us). matagorda co.: Bay City, *E. J. Palmer 9629* (ds, mo, us). montgomery co.: 7 mi. S. of Conroe, *Shinners 7742* (smu). morris co.: Daingerfield St. Park, *D. S. & H. B. Correll 12440* (smu). newton co.: 4 mi. S. E. of Newton, *Shinners 7656* (rm, smu, uc). orange co.: Vidor, *M. B. Wood* (mo, uc). panola co.: 18 mi. N. W. of Carthage, *Shinners 7595* (gh, smu). polk co.: Livingston, *E. J. Palmer 5249* (mo, us). refugio co.: (w/o locality), *H. C. Benke 5439* (gh). robertson co.: 3.75 mi. S. E. of Hearne, *Cory 55732* (smu, us, ws). rusk co.: Henderson, Apr. 16, 1943, *M. Riedel* (mo), sabine co.: 15 mi. N. of Jasper, *Shinners 7637* (smu). san augustine co.: San Augustine, (w/o date), *G. L. Crocket* (us). shelby co.: 16 mi. S. E. of Center, *Shinners 7627* (smu). smith co.: Tyler St. Park, *Cory 63392* (gh, smu). travis co.: Austin, *Tharp 1378* (uc, us). tyler co.: 7 mi. S. of Woodville, *Whitehouse 23303* (smu). van zandt co.: 6.7 mi. E. of Grand Saline, *Van Vleet 1105* (smu). victoria co.: 10.5 mi.W. of Victoria, *Cory 55117* (smu, us). walker co.: (w/o locality), *R. A. Dixon 512* (cas, us). waller co.: Hempstead, *E. Hall 357* (gh, mo, ny). wash-

INGTON CO.: Brenham, Apr. 21, 1935, *V. Lehman* (NY). WILSON CO.: Sutherland Springs, *M. E. Jones 29436* (MO). WOOD CO.: Mineola, *Reverchon 2575* (MO, SMU).

10b. **Hymenopappus artemisiaefolius** var. **riograndensis** var. nov.

Herbae biennes, caulibus 2–8 foliatis, 45–100 cm. altis; foliis inferioribus integris 1-pinnatisve, 10–20 cm. longis, 2–5 cm. latis; pedunculis ebracteatis, 2–5 cm. longis; inflorescentiis magnis laxe cymoso-paniculatis, 20–60-capitulatis; involucris campanulatis, bracteis 5–7 mm. longis, 2–4 mm. latis, apice ad 1 mm. membranaceis; flosculis 3–3.5 mm. longis, tubo 2 mm. longo, lobis acutis ad 1.5 mm. longis; achaeniis villosis 4–5 mm. longis, capillis albidis 1–1.2 mm. longis; pappo conspicuo, squamellis lineari-oblongis, 1.5–2 mm. longis.

Plants biennial, 45–100 cm. high; principal rosette leaves 10–20 cm. long, 2–5 cm. wide, tomentose on both surfaces, simple to once-pinnate with broad, coarsely toothed divisions; stem leaves 2–8, much reduced upward; heads 20–60 per stem, campanulate, 40–60-flowered, on slender, bractless ultimate peduncles 2–5 cm. long; inflorescence a large, open cymose panicle, often comprising ⅔ of the plant height; principal involucral bracts 5–7 mm. long, 2–4 mm. wide, the apex narrowly obtuse or acute with an inconspicuous, yellow-membranous tip 1(2) mm. long or less; corollas "yellow-reddish," 3–3.5 mm. long, the tube sparsely glandular, 2 mm. long, the throat campanulate-funnelform, 1.5 mm. long with lobes reflexed, 1–1.2 times longer than the acute lobes; achenes 4–5 mm. long, pubescent principally on the corners with white hairs (0.8–)1–1.2 mm. long; pappus of 16–18 linear oblong scales, 1.5–2 mm. long; anthers exserted, 2–2.5 mm. long; chromosome number $n = 17$. Type: Texas. Brooks Co.: 2 mi. S. of Falfurrias, in deep sandy soil. March 20, 1952, *F. B. Jones 695* (SMU). Phototypes WS, TEX.

DISTRIBUTION.—Rio Grande Valley of Southern Texas in open gravelly or sandy-clay soils of the lower Gulf Coastal Plain. (Fig. 47).

This plant is a distinct variety which differs from *Hymenopappus artemisiaefolius* var. *artemisiaefolius* in a number of characters, including its more pubescent achenes, larger pappus, smaller corollas, fewer stem leaves, involucral bracts with inconspicuous membranous tips, and ebracteate peduncles. The latter two characters seem to link the variety to *H. scabiosaeus* var. *corymbosus*, but the total characters are those of *H. artemisiaefolius*. Further, the morphological characters listed above intergrade to a large extent with those of *H. artemisiaefolius* var. *artemisiaefolius* where the peripheral ranges of these two varieties approach each other. As yet, no similar intergradation has been found with H. *scabiosaeus* var. *corymbosus*. It is unlikely that the specimens cited represent hybrids or hybrid

swarms between this species and *H. artemisiaefolius* var. *artemisiaefolius*, since the variety has characters which are peculiar to itself, such as its long pappus and achenial hairs (remarkably similar to those of the *H. filifolius* complex).

*Hymenopappus* in the Rio Grande Valley of southern Texas is in critical need of field study both because of the scarcity of material from the area and because of the variability shown by the few specimens of the genus collected in this region. With the accumulation of more specific information, present concepts as to the relationship and status of var. *riograndensis* may have to be changed, but from the evidence available it seems best to consider it no more than a well marked variety of *H. artemisiaefolius*.

Representative specimens.—**Texas.** Brooks co.: 2 mi. S. of Falfurrias, *F. B. Jones 695* (SMU); near Fulfurrias, *Perkins & Hall 2857* (POM). Cameron co.: Point Isabel, *R. Runyon 224* (US). Kenedy co.: Norias Division of King Ranch, *M. C. Johnston 54595* (TEX); Kleberg co.: Santa Gertrudis Division of King Ranch, *M. C. Johnston 54483* (TEX). Hidalgo co.: 10 mi. N. of San Manuel, highway 281, *R. Runyon 2634* (US). Refugio co.: 5.5 mi. S.E. of Austwell, *Cory 49078* (GH, SMU). (This specimen approaches var. *artemisiaefolius*.) Willacy co.: loose sand prairie a few mi. W. of Redfish Bay, *M. C. Johnston 54562* (TEX).

## EXCLUDED SPECIES

*Hymenopappus anthemoides* Juss. Ann. Mus. Par. **2:** 426. 1803. = Hymenoxys anthemoides (Juss.) Cass.

*Hymenopappus douglasii* Hook. Fl. Bor. Am. **1:** 316. 1834. = Chaenactis douglasii (Hook.) Hook. & Arn.

*Hymenopappus glandulosus* (S. Wats.) Rydb. N. Amer. Fl. **34:** 38. 1914. = Hymenothrix glandulosus S. Wats.

*Hymenopappus glaucus* Spreng. Syst Veget. **3:** 449. 1826. = Cephalophora glauca Cav.

*Hymenopappus integrifolius* (Nutt.) Spreng. Syst. Veget. **3:** 449. 1826. = Polypteris integrifolius Nutt.

*Hymenopappus ligulaeflorus* Nelson, Wyoming Expt. Sta. Bull. **28:** 135. 1896. = Hymenoxys richardsonii (Hook.) Cockerell.

*Hymenopappus matricarioides* Spreng. Syst. Veget. **3:** 450. 1826. = Ageratum matricarioides (Spreng.) Less.

*Hymenopappus nelsoni* (Greenman) Rydb. N. Amer. Fl. **34:** 49. 1914. = Hymenothrix glandulosa var. nelsonii Greenman.

*Hymenopappus nevadensis* Kellogg, Proc. Calif. Acad. **5:** 46. 1873. = Chaenactis nevadensis (Kellogg) Gray.

*Hymenopappus palmeri* (Gray) Hoffm. in Engler & Prantl. Nat. Pfl. **45:** 256. 1897. = Hymenothrix palmeri Gray.

*Hymenopappus pedatus* Cav. ex Lag. Gen. et. Sp. Nov. 28. 1816. = Florestina pedata (Cav.) Cass.

*Hymenopappus wislizeni* var. *setiformis* M. E. Jones, Contrib. West. Bot. **12:** 47. 1908. = HYMENOTHRIX WISLIZENII Gray

*Hymenopappus wrightii* (Gray) H. M. Hall, Univ. Calif. Publ. Bot. **3:** 179. 1907. = HYMENOTHRIX WRIGHTII Gray.

*Hymenopappus wrightii* var. *viscidulus* Jepson, Man. Fl. Pl. Calif. 1128. 1925. = HYMENOTHRIX WRIGHTII Gray.

In addition, the following species of *Rothia* Lam., *sensu* O. Kuntze (1898) are not *Hymenopappus: Rothia degenerica, Rothia intermedia, Rothia pinnata, Rothia pinnata pallida, Rothia pinnata purpurescens, Rothia pusilla.*

THE PLANT RESEARCH INSTITUTE, THE UNIVERSITY OF TEXAS, AUSTIN, TEXAS.

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Notes on Collinsia violacea.—The designation of *Collinsia violacea* Nutt. as a spring annual, in spite of its very early flowering habit, has seemed worthy of observation to the writer. Both *C. violacea* Nutt. and *C. verna* Nutt. are found in Illinois, and the former has been collected only in Shelby County in the central part of the state where it has been reported for 20 years. The latter species is a rather common early spring flowering plant in widely separated moist woodlands throughout Illinois.

Flowering records for *Collinsia violacea* in this state indicate that it is in bloom from late April through May. In his *Scrophulariaceae of Eastern Temperate North America*, Francis W. Pennell says, "Our species are spring-annuals of deciduous forests, dying when the trees have reached full foliage." (Page 290). In

April 1955 the writer, with Dr. G. D. Fuller of Chicago, transplanted some Shelby County seedlings of *C. violacea*, then in bud, to a garden in Springfield, Sangamon County, Illinois. These "garden" plants thrived, flowered and produced seed. During November of the same year it was observed that Collinsia seedlings had appeared in abundance. Such observation later prompted a visit to the Shelby County locality, and on March 6, 1956, vigorous seedlings of *C. violacea* were seen. Thus it appears that "spring-annual" is not a good designation for this species, and use of "winter annual" is suggested as a better description. No data have been personally collected for *C. verna*, but Mr. Harry E. Ahles of the Botany Department, University of North Carolina, reports (in correspondence) that he observed seedlings of *C. verna* in Brownfield Woods, Champaign County, Illinois, behaving in the same manner as that described for *C. violacea*. *Collinsia violacea* propagates easily from seed and probably will thrive in suitable habitats in many localities.—Glen S. Winterringer, Illinois State Museum, Springfield, Illinois.

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Tiarella cordifolia in Wisconsin.—False miterwort or foamflower (*Tiarella cordifolia* L.) has not previously been reported for Wisconsin. The late Dr. N. C. Fassett in the preliminary report on the Saxifragaceae (1932) referred to the range of this species as reported in Gray's Manual, edition seven, as west to Minnesota and indicated that it should be sought in Wisconsin.

Two specimens are contained in the University of Wisconsin Herbarium: *G. S. Cornwall*, Wis. (?), not dated and *C. Goessl*, Wisc., June 7, 1922. The poor data present and the fact that Fassett omitted any reference to these sheets is sufficient to suggest that they did not constitute a satisfactory first record. There is the possibility that they were not native collections.

The writer, while examining specimens in the Plant Ecology Collections, encountered a fine specimen, collected in flower by Messrs. *G. Cottam*, *R. T. Brown*, and *R. P. McIntosh*.

The plant was collected June 20, 1950, in a hemlock-hardwood stand in Florence County (T39N, R17E, S8). The stand was composed mainly of sugar maple, hemlock, basswood, yellow

birch and hornbeam with a scattering of balsam fir and slippery elm. Dominant understory associates were *Aralia nudicaulis*, *Aster macrophyllus*, *Erythronium americanum*, *Galium triflorum*, *Mitella nuda*, *Maianthemum canadense*, *Streptopus roseus* and *Trientalis borealis*.

The genus *Tiarella* in North America, has been monographed by Lakela (1937) and the specimen in question conforms most closely to the description of *Tiarella cordifolia*, typical variety. Manistee, Southern Michigan was apparently the most northwestern point of collection for the species known to Lakela.

This report provides an authentic first record for this species in Wisconsin and an extension of approximately 200 miles in a northwesterly direction of the range as cited in Lakela (1937). The specimen is deposited in the University of Wisconsin Herbarium.—Paul F. Maycock, dept. of botany, university of wisconsin.

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Medicago polymorpha var. vulgaris.—There is nothing like intense concentration on an intricate and perplexing problem to blind one to the very obvious. *Medicago polymorpha* L. var. *ciliaris* L., 1753, of course makes illegitimate my new combination based on *M. denticulata* var. *ciliaris* Ser. (Rhodora 58: 9). Our commonest bur clover, so-called *M. hispida*, must be *M. polymorpha* var. **vulgaris** (Benth.) comb. nov., based on *M. denticulata* var. *vulgaris* Benth., Cat. Pl. Ind. Pyr. p. 103, 1826. Under this go f. **apiculata** (Willd.) comb. nov., based on *M. apiculata* Willd., Sp. Pl. 3: 1414, 1802; and f. **tuberculata** (Godron) comb. nov., based on *M. polycarpa* var. *tuberculata* Godr. in Gren. & Godr., Fl. France 1: 390, 1848.—Lloyd H. Shinners.

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PLATE 1227. Page 52 of the Herbarium of Thomas Walter at the British Museum. FIG. A. Lectotype of *Helenium vernale* Walt. FIG. B. Syntype of *Helenium aestivale* Walt. FIG. C. Lectotype of *Helenium aestivale* Walt. FIG. D. Lectotype *Helenium serotinum* Walt.

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## THE BINOMIALS OF HELENIUM IN WALTER'S FLORA CAROLINIANA


Howard F. L. Rock


In the course of a recent revision (unpublished) of the decurrent-leaved species of the genus *Helenium* L., it became necessary to critically evaluate the binomials used by Thomas Walter in the genus for his *Flora Caroliniana* (1788). The general importance of the *Flora Caroliniana* in North American taxonomy and particularly in that of the southeastern United States has been noted by Blake (1915), Maxon (1936) and more recently by Totten (1956). The significance of Walter's treatment of the genus *Helenium* lies in the fact that he created three new binomials within the genus. The identity of these binomials has long been intriguing, the more so in that they ostensibly did not apply to the even then highly segregated species, *Helenium autumnale* L.

In evaluating these binomials there are two direct sources of evidence and data. The first of these, the descriptions provided in the *Flora Caroliniana*, is unfortunately rather meagre, the descriptions being quite short. Therefore, for clarity of exposition and ease of reference, the text of Walter's treatment is reproduced below. The second of these sources is Walter's herbarium, which is preserved at the British Museum of Natural History. Inasmuch as John Fraser carried Walter's personal herbarium to England at the same time as he did the manuscript of *Flora Caroliniana*, it can be presumed that one was to serve as a supplement to the other. Nevertheless, it seems that the specimens of Walter's herbarium have either been

ignored or else overlooked in previous evaluations of the binomials. To these two sources can be added the modern knowledge of the Southeastern flora and these provide the basis for the interpretation and disposition presented herein.

327. HELENIUM. *Receptaculum* disci nudum, radii paleaceum. *Pappus* margo 8-partitus. *Calyx* simplex multipartitus. *Corollulae* radii 3 4 vefidae *discus* semiglobosus.

*vernale* 1. foliis oblongis alternis integris, floribus solitariis terminalibus luteis, petalis radii (24) trifidis.

*aestivale* 2. foliis oblongis integris, flosculis radii sex luteis quadrifidis, disco purpureo, pappo subsetaceo.

*serotinum* 3. foliis serratis sessilibus caule laevi, floribus luteis, corollulis radii duodecim.

autumnale 4. foliis serratis decurrentibus, caule ramoso alato, flosculis radii 12 luteis, disco purpureo aliquando geminato.

The description of *Helenium vernale* sensu Walt. can be applied to two of the vernal species of *Helenium* found in the Southeastern Coastal Plain, *Helenium Nuttallii* A. Gray and *Helenium pinnatifidum* (Nutt.) Rydb. The description fits either one equally well, with the exception of the adjective "integris." The entire-margined condition of the leaves is more characteristic of *H. Nuttallii* than it is of *H. pinnatifidum*. Nevertheless, *H. pinnatifidum* very often occurs with entire-margined basal leaves, particularly so in the Florida-Georgia area of its distribution. Over the course of the years, however, *H. vernale* Walt. has been interpreted as applying to the same taxon as *H. pinnatifidum* (Nutt.) Rydb.

Morphologically, *Helenium pinnatifidum* is characterized by having pubescent achenes, peduncles and involucral bases that are pubescent, mid-cauline leaves that are only shortly decurrent (4 mm. or less) along the stem and by radical leaves that are usually pinnatifid in outline and not with petioloid bases. The distribution of *H. pinnatifidum* is in the outer portions of the Costal Plain, more so than *H. Nuttallii*, and extending farther southeastward into peninsular Florida and northeastward into southeastern North Carolina. However, a simple check of the specimen (Fig. A) in the Walter Herbarium that most closely fits his description[1] reveals that the achenes are glabrous and

[1] Morphological data provided by Mr. W. T. Stearn of the British Museum of Natural History.

that the peduncle is glabrous as well. These characters are diagnostic of *H. Nuttallii* and the author is convinced that if the midcauline leaves were present on the specimen they would be conspicuously decurrent and that the radical leaves would be more entire rather than pinnatifid and would have petioloid bases. In addition, *H. Nuttallii* has a distribution that is more toward the inner portion of the Coastal Plain than *H. pinnatifidum* and is the only species of the two in question that occurs with regularity in Berkeley County, South Carolina. Moreover, the pappus scales of the Walter specimen correspond more closely to the stereotype of the pappus scales of *H. Nuttallii* than they do to that of *H. pinnatifidum*. Regrettably, the variable nature of the pappus scales in both taxa is such that there is a degree of overlapping and intergradation in the size and shape of the scales to the extent that the pappus scale characteristics are not as differential criteria as those presented above.

In the course of time, then, the binomial *Helenium vernale* has come to be misapplied to the taxon which was rightfully named *H. pinnatifidum* (Nutt.) Rydb., while the name *H. Nuttallii* A. Gray, which now becomes a synonym, has usurped the rightful position of *H. vernale* sensu Walt. The importance of the specimen in the Walter Herbarium and its preservation cannot be overstressed in relation to the binomial, for were it not for the specimen, the binomial would have to be declared a *nomen dubium* inasmuch as neither the epithet nor the brief description are sufficient to resolve the problem of its correct application.

It is the author's considered opinion that the binomials *Helenium aestivale* Walt. and *Helenium serotinum* Walt., long held as *nomina dubia*, do not have application to any of the species of *Helenium*, and most particularly not to any of those species encountered in the flora of the Southeastern United States. It is my belief that these two binomials apply instead to the genus *Gaillardia*, and that Walter made no distinction between the genus *Helenium* L. and the genus *Gaillardia* Fougx. (1787).[2] This is not so surprising, for Walter classified his

[2] Walter was probably not aware of Fougeroux's paper, due in part to the time lapse in communication between Europe and North America and in part to the obscurity of the original publication in relation to botany.

*H. vernale* along with the other species of *Helenium* in the *Flora* under the class *Syngenesia Polygamia Superflua*, even though by virtue of the neutral and sterile ray florets it patently belongs to the class *Syngenesia Frustrania*. Indeed, according to the interpretation presented herein, all the binomials of Walter in the genus *Helenium*, whether they be truly members of *Helenium* or *Gaillardia*, would be classified as pertaining to the *Syngenesia Frustrania* for both the vernal species of *Helenium* and the species of *Gaillardia* are characterized by neutral and sterile ray florets.

The three remaining specimens in the Walter Herbarium labeled *Helenium* are in fact specimens of *Gaillardia* Fougx. These specimens belong to the Section HOLLANDIA Biddulph (1944) of the genus *Gaillardia*. This section of the genus is based on the characters listed below:

1. Receptacle with small dentiform setae;
2. Style branches long and hispidulous;
3. Lobes of the disk corollas caudate-acuminate.

It is to be noted that the setiferous character of the receptacle usually associated with *Gaillardia* as a diagnostic generic character becomes less than distinctive within this section, especially in relation to the character of the receptacle in *Helenium*. In fact and in practice, no real distinction can be made between the genus *Helenium* and the section HOLLANDIA (*Gaillardia*) solely on the basis of the receptacular surface and its projections. Of these three *Gaillardia* specimens, two belong to the species *Gaillardia lanceolata* Michx. while the remaining one would be referred to *G. lutea* Greene according to present usage. Whether these specimens were collected in Berkeley County, South Carolina or not, is a moot question. Most likely they were collected to the southeast or southwest of Walter's area and probably by John Fraser who traveled in both South Carolina and Georgia (fide Maxon). Biddulph records *G. lanceolata* from Aiken County, South Carolina[3] as well as from Georgia, Florida and thence westward into Texas. East of the Mississippi River, she records *G. lutea* from Baldwin County, Alabama and Brevard County, Florida.

[3] Specimens of *G. lanceolata* are on deposit in the Duke University Herbarium from Sumpter Co., S. C. and Columbus Co., N. C.

The description of *Helenium aestivale* Walt. can certainly be applied to *Gaillardia lanceolata* Michx. The characters of oblong, entire leaves; few yellow rays; purple disk; and subsetaceous (long-awned) pappus have no real meaning in relation to any species of *Helenium* that occurs in the Southeastern United States but do apply to *G. lanceolata*. In the same manner, if *Helenium serotinum* Walt. is equated with *G. lutea* Greene, then the description provided by Walter agrees with the particulars that Biddulph gives for that taxon.

The author is aware of the dangers and fallacies that can arise in interpreting descriptions in terms of specimens and *vice versa* but if the binomial *Helenium vernale* Walt. is to be maintained then *H. aestivale* Walt. and *H. serotinum* Walt. should also be maintained, for certainly the latter two binomials are no more dubious than the former. In view of the priority of the epithets of Walter over those of later authors and according to Article 65 of the *International Rules of Botanical Nomenclature* (7th ed.), which states that prior epithets must be reinstated, there being no obstacle to their reinstatement, the following new combinations are proposed:

**Gaillardia aestivale** (Walt.) H. Rock, comb. nov.[4]
*Helenium aestivale* Walt. Fl. Carol. 210. 1788.
*Gaillardia lanceolata* Michx. Fl. Bor.-Am. **2:** 142. 1803.

**Gaillardia serotinum** (Walt.) H. Rock, comb. nov.[5]
*Helenium serotinum* Walt. Fl. Carol. 210. 1788.
*Gaillardia lutea* Greene Pittonia **5:** 57. 1902.

The remaining binomial used by Walter in the *Flora* is *Helenium autumnale* sensu Walt. (non Linnaeus). This binomial is not represented by a specimen in the Walter Herbarium. However, from the description and from the epithet, it is evident that what Walter considered to be *Helenium autumnale* L. is *Helenium flexuosum* Raf. (*H. nudiflorum* Nutt.) The decisive factor in this interpretation is the phrase "disco purpureo", one of the most obvious characters that serves to distinguish *H. flexuosum* from *H. autumnale*. However, in the light of the widely variable and descriptive polynomial synonymy

[4] Lectotype: *Helenium aestivale* Walt., specimen No. 235, Walter Herbarium (BM), (Fig. C).
[5] Lectotype: *Helenium serotinum* Walt., specimen No. 243, Walter Herbarium (BM), (Fig. D).

listed under *H. autumnale* by Linnaeus (1753), Walter's inclusion of the later defined *H. flexuosum* with *H. autumnale* is indeed warranted. Even though *H. flexuosum* is classified on technical characters along with the vernal-flowering species of *Helenium* (*Leptopoda* Nutt.), its actual flowering period in Walter's area ranges from mid-June through late October. It is the author's personal experience that *H. flexuosum* is one of the conspicuous and most abundant composites in the immediate vicinity of Walter's grave and former garden and of that area of South Carolina in general.

An alternate possibility is that *Helenium autumnale* sensu Walt. is the same as *H. brevifolium* (Nutt.) Wood. However, *H. brevifolium* is distinctly vernal in its flowering habit and while rather endemic in the nature of its distribution northward of the Gulf Coastal Plain, it is unreported from South Carolina. Moreover, the small number of ray florets cited by Walter would rule against *H. brevifolium* as a possibility, for in that taxon the number of ray florets is usually well in excess of twenty rays.

Even though Walter's descriptions are short and concise, the pattern of the phrasing and the order of arrangement of the species appears to have a significance that exceeds that of just mere description. If one allows some liberality in translation and a slight amount of change in the sequence of the phrases, but maintaining the order of the species, the following key can be constructed solely on the basis of the descriptive material provided by Walter.

1. Leaves entire and oblong
   2. Ray florets 24 in number, trifid; heads solitary, terminal and yellow; leaves alternate..... *Helenium vernale.*
   2. Ray florets 6 in number, 4-fid; disk purple; pappus sub-setaceous (long-awned)..... *Helenium aestivale.*
1. Leaves serrate
   3. Leaves sessile (not decurrent); stem smooth (not winged); heads yellow; ray florets 12 in number..... *Helenium serotinum.*
   3. Leaves decurrent; stem winged and branched; disk purple; ray florets yellow and 12 in number... *Helenium autumnale.*

It is just such an analytical device that perhaps contains the answer to the contention raised by Dr. Baldwin in a letter[6] to Stephan Elliott:

[6] An undated letter from Dr. Baldwin of Georgia to Stephan Elliott of Charleston, South Carolina. The letter is now mounted with the lectotype of *Leptopoda puberula*

That the first mentioned species of *Galardia* is the *Helenium vernale* of Walter I contend—Walter would scarcely have omitted the fol. [iis] decurrent. [ibus] It is probable that he was ignorant of the species with decurrent leaves. . . .

From the schema above it can be seen that the decurrent-leaved condition has no bearing on the relation of *Helenium vernale* to the other three species of Walter's *Flora*. Rather, the question of whether the leaves are decurrent or not is raised only in effecting a decision between *Helenium serotinum* and *Helenium autumnale*. The fact that Walter did not state that *Helenium vernale* has decurrent leaves cannot be taken to infer that the leaves are non-decurrent, for by the same token, neither did he state that the leaves are sessile as he explicitly does for *Helenium serotinum*. Therefore, in view of the pattern and the phraseology of Walter's descriptions, it seems reasonable to assume that Walter intended the descriptive material to be diagnostic as well, even though he did not adopt a key-like format, an innovation which apparently originated in the same year (1788), with the publication of Lamarck's *Flore Françoise*.—

DEPARTMENT OF BOTANY, DUKE UNIVERSITY.

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MacBride in Ell. contained in the Elliott Herbarium of the Charleston Museum. In the above quotation, the *Galardia* referred to is *Galardia fimbriata* Michx., a *nomen rejiciendum*, which is synonymous in part with *Helenium pinnatifidum* (Nutt.) Rydb.

# NOTES ON A NEW HYBRID CAREX[1]

Egbert W. Fell

The following is an extract from a paper entitled "Carex of Rock River Valley in Illinois" which Dr. Fuller, Mr. Ahles and I presented at the meeting of the Illinois State Academy of Science at Carbondale in 1955. It has not been published.

The *Carex* under discussion was discovered by me in April 1949 growing on the wooded gravel bluff of Rock River south of Rockford at the north edge of Camp Grant. The bluff, about 50 feet high, a part of Rock River terrace, is water-lain sand and gravel without loess or ice-borne till. It has a western exposure and is lightly shaded. It supports the remains of a prairie vegetation but is now wooded with *Quercus velutina*, *Q. alba* and *Q. macrocarpa*, a transition from prairie to mixed oaks, the trees having advanced upward from the very narrow flood plain. Associated plants are, beside a few choke-cherry bushes (*Prunus virginiana*), a mixture of prairie plants and mesophytes: *Bouteloua curtipendula, Leptoloma cognatum, Panicum scribnerianum, Aristida basiraema, A. oligantha, Carex meadii, C. pensylvanica, C. muhlenbergii, C. sprengelii, C. normalis, Claytonia virginica, Arenaria stricta, Dicentra cucullaria, Corydalis flavula, Draba reptans, Oxalis violacea, Dodecatheon meadia* and *Penstemon pallidus.*

The *Carex* grows in a patch about 75 feet in diameter on the crest of the bluff. During the past 7 years it has increased in size about one quarter. In the average winter the basal part of the plant stays green. Spring growth starts early, the thick staminate spike becoming conspicuous only a little later than *C. pensylvanica.* Achenes develop incompletely and infrequently, varying in different years. I have found no mature achenes.

I asked Mr. Ahles to write this description of the plant naming it for Dr. George Damon Fuller, who has been familiar with it from the time of its discovery. Last spring I sent Mr. Ahles, in Urbana, living plants of the hybrid, of *C. pensylvanica*, *C. laeviconica* and *C. meadii* from this area, but it was too late to

[1] A contribution from the Evelyn I. Fernald Memorial Herbarium of Rockford College, Rockford, Illinois.

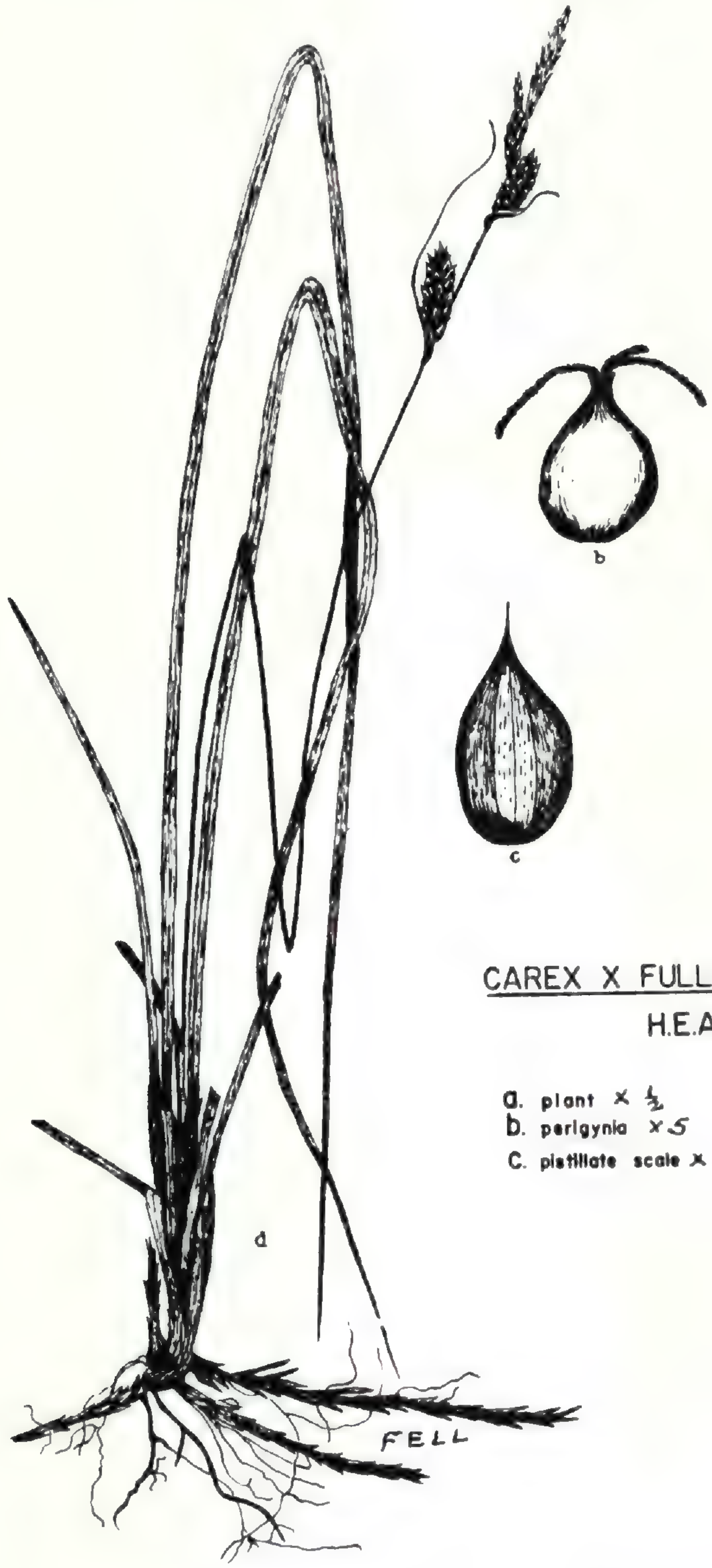


FIG. 1. CAREX × FULLERI H. E. Ahles, hyb. nov. Plant × ½. Pistillate scale and perigynium × 5.

do crossing experiments. It was expected that this would be undertaken during the spring of 1956, but the move of Mr. Ahles from University of Illinois to University of North Carolina interrupted the plan. Dr. Frederick J. Hermann and Dr. Theodore Just are familiar with the plant through herbarium specimens. There is apparent agreement as to its probable hybrid origin, though its location, just where the service area of the Base Hospital was during the first world war, suggests the possibility of its being an accidental introduction.

**Carex × fulleri** H. E. Ahles, hyb. nov. A sterile hybrid possibly of *Carex laeviconica* Dewey and *C. pensylvanica* Lam. The plant forms small tufts of 2 to 5 erect culms at the end of long, slender rhizomes which reach a length of 1–2 dm. The rhizomes are covered with long, narrow, overlapping, fibrillose scales 12 mm. in length. The internodes on the rhizome measure about 10 mm. The leaves, 4 mm. wide or less, are glaucous, scabrous on both surfaces, chiefly basal, and overtop the inflorescence by as much as 1 dm. The sharply angled culms, 5 dm. tall, are very thin, less than 1 mm. thick, and are scabrous at the top. The lowest pistillate spike is sessile or very short stalked, usually distant, upper one or very rarely two, crowded at base of staminate spike, sessile; all oblong-cylindric, 10–25 mm. (in general nearer 10 mm.) long, 5–10 mm. broad, densely flowered; dark purplish-brown scales with lighter central band, acuminate, 5 mm. long and 2 mm. wide, midrib prominent; staminate spike terminal, 15–30 mm. long, 3–4 mm. wide, straw colored; perigynia brown, dull, 3 mm. long, ovoid, gradually contracted to the short, smooth, bidentate beak, 0.2 mm. in length. Pistil three-parted; achene not developed, but the immature achene sharply triangular. Fig. 1.

Culmis 5 dm. altis, erectis; foliis 4 mm. sive minus latis, glaucis, scabrosis. Spicis femineis sessilibus sive subsessilibus, oblongo-cylindricis, 10–25 mm. longis, 3-10 mm. latis, dense floribus intertextis. Perigyniis fulvis, surdis, 3 mm. longis, ovoideis, gradatim in breve rostrum, glabrum, bidentatum 0.2 mm. longum contractis. Pistillo tri-partito. Achenio non evoluto sed acute triangulari.[2]

TYPE SPECIMEN: Illinois, Winnebago County, wooded gravel bluff of Rock River at Camp Grant, south of Rockford, June 16th, 1954, *E. W. Fell 54–489.* Additional collections from the same area are: April 29th, 1949, *E. W. Fell 49–115;* May 23rd, 1953, *E. W. Fell 53–147;* July 6th, 1953, *E. W. Fell 53–679.*

Specimens cited are all in the University of Illinois Herbarium. Duplicate specimens are in the Illinois State Museum Herbarium."—ROCKFORD, ILLINOIS.

[2] Assistance was given by Professor J. L. Heller, Head of the Department of Classics, University of Illinois, in preparing the Latin description.

# ADDITIONS AND EXTENSIONS TO THE FLORA OF MANITOBA

J. C. Ritchie

An opportunity to spend part of the summer of 1955 in northwest Manitoba enabled the writer to make detailed local studies in two regions which had not been explored by any botanist. Four additions, and certain notable extensions to the known flora which resulted from this work are reported here. Detailed floristic and ecological accounts will be published elsewhere. The information which is reported here was not available in time to be included in the forthcoming flora of the province by Dr. H. J. Scoggan. The northwest region of Manitoba has received little attention from botanists, and only the collection of Baldwin (1953) provides representative information about the area. The present material was collected from two main areas, at MacBride Lake (56° 52′ N., 99° 57′ W) and Tod Lake (56° 45′ N., 101° 47′ W). In the following account the writer's collection numbers are shown in italics and the Herbaria of the University of Manitoba and the Department of Agriculture, Ottawa are referred to as MAN and DAO respectively.

**Woodsia alpina** (Bolton) S. F. Gray. Tod L. *1264*. Only one locality for this plant was established; it was found in a deeply shaded cliff ledge on the north-facing side of a high outcrop ridge on the northwest shore of Tod Lake. This is the first authentic record for the province; reports by Macoun (1890) and Lowe (1943) have not been substantiated by any specimens.

**Cystopteris dickieana** Sim. Tod L. *1263*. Growing in close association with *Woodsia alpina* (*1264*), this species was recorded from only that locality. This is the fourth record of the plant from Manitoba, the others being at Churchill (Ritchie, 1956) and from two localities near The Pas, about 300 km. south of the present locality (cf. map in Löve and Freedman, 1956).

**Dryopteris phegopteris** (L.) Christens. Tod L. *1257*. The only record, it was noted in rich wet soil below a small beaver dam under black-spruce and poplar. This is the first specimen collected in the province; Macoun's (1890. p. 269) report that it is "rather scarce along Lake Manitoba and the Porcupine Mountains, Man." is unsupported by any specimens.

**Potamogeton robbinsii** Oakes. Macbride L. *1214*. This aquatic was found in local abundance in certain shallow arms of MacBride Lake where it forms a broad submerged (at about 1 m.) zone of vegetation with *P. alpinus* var. *tenuifolius*. This is the second record from Manitoba; a

specimen was collected by B. J. Marck in 1936 (DAO) from Bissett, in the southeast corner of the province, about 750 km. from the present station.

**Schizachne purpurascens** (Torr.) Swallen. Tod L. *1247*. Recorded in well drained mineral soil on a south-facing, unshaded site on the summit of a high outcrop ridge, this extends northwards the area of this species in the province; the previous northern limit was at Cross Lake (Scoggan, 1950), about 250 km. southeast from the present station.

**Carex heleonastes** Ehrh. MacBride L. *968, 1024, 1147, 1185*. Never found in local abundance, this apparently rare sedge was discovered with surprising ease in several peat bogs in the area. Here it is confined to large cushions of *Sphagnum warnstorfianum* and *Camptothecium nitens*, where it is associated with *Andromeda polifolia*, *Vaccinium oxycoccus*, *Rubus acaulis*, *Salix pedicellaris* var. *hypoglauca* and *Carex limosa*. Due to the lack of adequate material from the province—the only other specimens of the *C. heleonastes-amblyorhyncha* complex are of *C. amblyorhyncha* from Churchill (Böcher, 1952)—it is not yet possible to provide representative information about this species.

**Carex leptalea** Wahl. MacBride L. *1143*. Apparently a plant of restricted ecological amplitude, it was collected from the peaty banks of a small muskeg stream where it was associated with *Carex paupercula* and *Caltha pal stris*. This record merely extends the northern limit of the plant in Manitoba (it is known from Keewatin) from The Pas and Churchill into the northwest corner of the province.

**Carex abdita** Bickn. Tod L. *1242*. A new record for the province, a single colony was found on the southern slope of the high outcrop ridge which bounds the northwest shore of Tod Lake. This record comprises a remarkable northern extension of this transcontinental American plant whose main area is in temperate latitudes.

**Carex lasiocarpa** Ehrh. var. **americana** Fern. MacBride L. *1219, 1221*. Both locally abundant and ecologically important this sedge forms a narrow zone at the periphery of certain lake-bogs, associated with *C. rostrata*, *Calla palustris* and *Menyanthes trifoliata*. This record extends northwards the area of the plant within the province from near Cedar Lake (Scoggan, 1950), a distance of about 400 km.

**Carex oligosperma** Michx. Tod L. *1270*. In local abundance at a single locality, it forms a zone of dominance in a small swampy depression over clay. This is the second authentic record and makes an extension northwards of 800 km. from the first locality which is in the southeast corner of the province. A new variety of this species has been discovered at Churchill, on Hudson Bay (described by Raymond in Ritchie, 1956).

**Acorus calamus** L. MacBride L. *1228*. A single colony was found, growing in the marginal bog vegetation of a shallow arm of MacBride Lake. This record extends the northern limit of the plant by 250 km. from Cross Lake where it was collected by Scoggan (1950).

**Salix pseudocordata** (Anderss.) Rydb. MacBride L. *1113*. A single plant of this was noted, growing in a muskeg where it was concomit-

ant with *Picea mariana, Salix myrtillifolia, Rubus chamaemorus, Sphagnum fuscum, S. warnstorfianum* and *Aulacomnium palustre.* This is the first record for Manitoba and it comprises a considerable (1000 km.) northeastern extension from the nearest known station, at Cypress Hills in southwest Saskatchewan where it occurs as an outlier of the main area of the plant which is in the southern Cordillera (Breitung, 1954).

**Salix hebecarpa** Fern. ( = ? *S. athabascensis* Raup) MacBride L. *990, 1029.* Two localities were established for this willow, and in both instances it grew in muskeg vegetation, associated with *Picea mariana, Betula glandulosa, Ledum groenlandicum* and other typical muskeg plants. The differences between this species and *S. athabascensis* are unconvincing, and the latter scarcely merits specific rank. *S. hebecarpa* is known only from Alaska (Hultén, 1943 p. 520–1) and the Gaspé Peninsula (Scoggan, 1950a p. 173). Possibly these are eastern and western subspecies of a single species, together forming a more or less continuous area in N. America. This record extends the provincial area northwards by about 600 km., from Riverton (Scoggan, 1953).

**Salix gracilis** Anderss. var. **textoris** Fern. MacBride L. *1205.* This was recorded only from certain rare stands of white-birch on raised peat ridges. It extends northwards by 300 km. the area of the plant from The Pas (collected by W. Krivda, MAN).

**Salix arbusculoides** Anderss. MacBride L. *985, 989.* This was recorded from muskeg in two localities. It is the second record for the province, the other being at Churchill, the eastern limit of the entire area of the plant.

**Arabis holboellii** Hornem. var. **collinsii** (Fern.) Rollins. Tod L. *1253.* Only one colony of plants was found, in dry soil on the southern slope of a high outcrop ridge at Tod Lake. This extends further the northern limit of this plant in the province from the locality established by Freedman (MAN) near Flin Flon, about 250 km. from the present area.

**Potentilla arguta** Pursh. Tod L. *1246.* The only specimen collected from the area, it was found in dry mineral soil on the south-facing slope of the summit of a high outcrop ridge. This extends northwards by 300 km. (from The Pas) the area of the plant in northwest Manitoba.

**Potentilla pensylvanica** L. var. **pensylvanica.** Tod L. *1251.* In the same locality as the previous two species, this record extends the area by 250 km. from the previous northern limit for the province at Cross Lake (Scoggan, 1950).

**Oxytropis splendens** Dougl. Tod L. *1241.* This was the only locality in the areas which were surveyed; here it was concomitant with the three previous species and *Artemisia caudata.* This record extends the area in the province by 600 km. northwards from the locality at Cowan, Duck Mountain (Scoggan, 1952).

**Artemisia caudata** Michx. Tod L. *1245.* Associated with the last four species, it was confined to dry, open sites on the summit of the ridge on the northwest shore of Tod Lake. This record extends the area northwards from Knee Lake (Scoggan, 1951) by about 300 km.

Certain of these additions and extensions are of phytogeographical interest. While it is apparent that the flora of northern Manitoba is incompletely known at present, several of the records which have been enumerated constitute remarkable outliers of the main areas of the plants, while others are rare or local, even in regions which have been explored in greater detail. Of these plants, *Woodsia alpina*, *Cystopteris dickieana*, *Schizachne purpurascens*, *Carex abdita*, *Arabis holboellii* var. *collinsii*, *Potentilla arguta*, *Potentilla pensylvanica* var. *pensylvanica*, *Oxytropis splendens* and *Artemisia caudata* were recorded only from the relatively high ridge which runs parallel to the northwest shore of Tod Lake. This ridge is of a somewhat exceptional geological nature, having arisen by considerable faulting between two series of sedimentary rocks (Milligan, 1952). Otherwise, by far the greater area of this entire region is of low relief, consisting of undulating glacial till ridges with the intervening depressions filled by lakes, muskegs and bogs, the whole showing little diversity of habitat and bearing a relatively poor flora, typical of much of the northern forested regions of the Canadian Shield. On this ridge on the exceptionally well drained upper slopes with a southern aspect, above small cliffs and therefore relatively unshaded by trees, were found *Schizachne purpurascens*, *Carex abdita*, *Arabis holboellii* var. *collinsii*, *Potentilla pensylvanica* var. *pensylvanica*, *Oxytropis splendens* and *Artemisia caudata*. Without exception these occurrences, near the northern limit of the continuous coniferous forest, are considerably beyond the main areas of these species, all of which are more typical of the southern deciduous forest and prairie vegetation zones. Further, the presence of exceptional cliff habitats provides, on the north-facing slopes, conditions of shelter and moisture which are suitable for such ecologically specialized ferns as *Woodsia alpina* and *Cystopteris dickieana*. It is suggested that these records provide some corroboration, at the regional flora level, of the thesis of Böcher (1951) that many discontinuities of area can be explained satisfactorily in terms of ecological factors.

The writer wishes to record his thanks to Dr. H. J. Scoggan who kindly provided much of the information about distribution within Manitoba. This work is being supported by generous

grants from the National Research Council of Canada.—DEPARTMENT OF BOTANY, UNIVERSITY OF MANITOBA, WINNIPEG, CANADA.

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# ANDROPOGON PRAEMATURUS, A FUNGUS-INDUCED MONSTROSITY[1]

Richard W. Pohl

*Andropogon praematurus* Fernald (Rhodora **42:** 413–415, 1940) was described as a new species of the section *Schizachyrium*, differing from *A. scoparius* in the following features:

1. Possession of only one pedicel or pedicellate spikelet at each node of the rachis—"Most remarkable, the sessile perfect spikelets, instead of being accompanied by a pair of truncate bearded pedicels or these terminated by mere rudiments, usually are accompanied by a single well developed staminate pedicelled spikelet." (p. 414)
2. Well-developed, staminate pedicellate spikelets.
3. Extremely early flowering.
4. Small size of plant.

Through the courtesy of Dr. Reed Rollins, it has been possible to examine the type specimen of *A. praematurus* (*Fernald and Long 10,092*, GH) and the other cited material of this species.

As described by Fernald, all specimens show one sessile and one pedicellate spikelet at each node of the rachis. This disposition of the spikelets is exactly the same as in all other species of *Andropogon* known to the author. Professor Fernald's statement that other species of this genus are different in having two sterile pedicels accompanying each spikelet is a misinterpretation. A detached unit of the inflorescence in the genus *Andropogon* consists of: 1. a sessile spikelet, 2. a pedicel bearing a pedicellate spikelet or a rudiment, and 3. the rachis internode which would normally bear the next distal similar unit. Such a detached unit might be interpreted as having two pedicels, but this is not the case. *A. praematurus* is therefore not exceptional in its inflorescence structure, a fact which has been pointed out by Agnes Chase (Man. Grasses U. S., Rev. Ed. 1950, p. 755).

The pedicellate spikelets of the type of *A. praematurus* and all other specimens of this "species" available to me do indeed have well-developed pedicellate spikelets. This development, however, is occasioned by the fact that all of them are heavily infected by a kernel smut (*Sphacelotheca sp.*). This fungus

[1] Journal paper No. J-2972 of the Iowa Agricultural Experiment Station, Ames, Iowa. Project No. 1136.

was kindly identified for me by Dr. J. C. Gilman. The pedicellate spikelets are not staminate, as stated by Fernald. The entire flowers of both the sessile and pedicellate spikelets are completely destroyed by the fungus infection. Fernald's plate of the inflorescence of the type specimen (Rhodora, **42:** pl. 626, fig. 3) well illustrates the typical smut pustules formed by *Sphacelotheca sp.*

Probably no plant species has ever been described from an entirely healthy individual, so the mere presence of a disease on the type specimen would not necessarily invalidate a new species. In the case of *A. praematurus*, however, all of the structural and physiological peculiarities upon which the species was differentiated may be ascribed to the well-known effects of systemic smut infection—malformation of organs, small stature, and early blooming.

The type of *A. praematurus* is to be regarded as a monstrosity induced by disease, and hence the species is to be rejected under the provisions of article 77 of the 1952 edition of the International Rules of Botanical Nomenclature. It could also be rejected under the provisions of article 76, since the appearance of the type is due to the combination of host and parasite, which are two genetically incongruous elements.

Some of the specimens which have been designated as *A. praematurus* have pubescent sheaths. These have been designated *A. praematurus* f. *hirtivaginatus* Fernald (Rhodora **44:** 383, 1942). These are also smutted individuals of *Andropogon*, section *Schizachyrium* and this name must also be rejected upon the same basis as that of the species.

There is considerable variation in both vegetative and parafloral structure of the specimens which have been denominated *A. praematurus.* It is possible that several species of *Andropogon* are involved, but in view of the fact that systemic smut infections may have altered all of the structures, it is probably pointless to attempt to determine the species.

---

Rubus Chamaemorus in the Canadian Lakehead.—The publication of the Occurrence of *Rubus Chamaemorus* L. in Minnesota,[1] brought to light additional information pertaining

[1] Lakela, O., Rhodora, **56:** 272–273. 1954.

to its midcontinental distribution. In a communication from Mr. Claude E. Garton, of Port Arthur, references were made to his own field observations and collections of the species and to those of Dr. T. M. C. Taylor in the Canadian Lakehead.

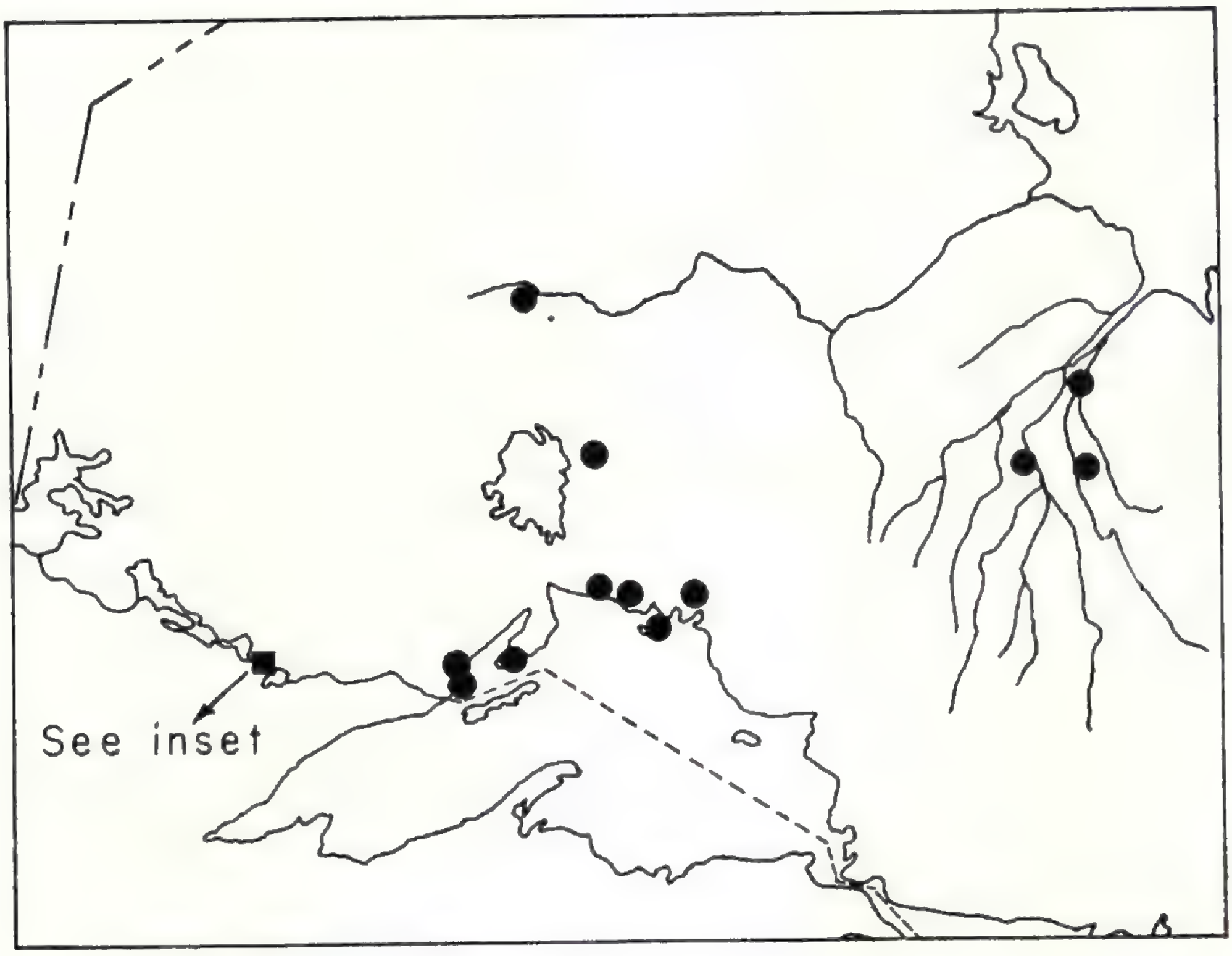
Dr. James H. Soper, University of Toronto, made available a list of collections of this species including those of Dr. Taylor and his associates with an unpublished manuscript map. With this information at hand, an attempt has been made to redefine the southern limit of the range of this arctic species and to relate to the distribution pattern on the Canadian side the single known station at Basswood Lake, Minnesota, some 120 miles west from Lake Superior.

The Canadian botanists collected the plant on Lake Superior north of the border more than 20 years ago. Mr. Garton, in 1952, discovered it on the north side of Pigeon Bay astride the International Boundary. Its absence on the south side is notable. The species is unknown in parts of Minnesota adjoining the Thunder Bay District.

Obviously the center of the interior distribution parallels the north shore of Lake Superior. The disjunct sites to the north and northeast are in Patricia and Cochrane Districts respectively. Westernmost is the Basswood Lake colony at 48° 07′ N. lat. and 92° 43′ W. long., the latitude approximating that of the Pigeon Bay colony, defining the southerly limit of the range.

With the exception of the first citation, from Mr. Garton's letter the collections herewith listed are deposited in the Herbarium of the University of Toronto, with the original distribution map, presumably plotted by Dr. Taylor, which was amended and adapted for its present use.

THUNDER BAY DISTRICT: In a sphagnum swamp at Amethyst Harbor, 23 mi. n.e. of Port Arthur, June 17, 1933. *Claude E. Garton.* Open wet sphagnum bog, north side of Pigeon Bay, Lake Superior, Crooks Twp., July 16, 1952. *Claude E. Garton 1865.* In sphagnum in spruce bog, Fork Bay, Sibley Twp., (lat. 48° 20′ N. long. 88° 50′ W.), June 23, 1936. *T. M. C. Taylor et al. 1286.* Spruce-cedar swamp, Rossport, (appr. 48° 45′ N. 87° 15′ W.), Aug. 11, 1937. *R. C. Hosie et al. 1996.* In black spruce, Bluejay muskeg, Schreiber, (appr. 48° 45′ N. 87° 15′ W.), June 30, 1937. *R. C. Hosie et. al. 1998.* Inland lake, east side of Patterson Is., Slate Islands, July 28, 1937. *R. C. Hosie et al. 1999.* Open spruce swamp, Marshy Lake, vicinity of Peninsula, (appr. 48° 45′ N. 86° 15′ W.), July 13, 1939. *T. M. C. Taylor et al. 1445.* Sphagnum bed, Onaman Lake, June 18, 1950. *W. L. Klawe 60.* Algoma District: "Clay Belt," June, 1905. *A. Henderson.* COCHRANE



MAP 1. RUBUS CHAMAEMORUS in the Interior of North America.

DISTRICT: In bog, among sphagnum, Smoky Falls, (appr. 50° 05′ N. 82° 10′ W.), July 24, 1935. *Jim Whelan 79.* PATRICIA DISTRICT: Spruce swamp near Nikip Lake, June 20, 1950. *A. T. Cringan, P. 18.* Clearing, edge of bush, Lake Attawapiskat, Aug. 18, 1939. *W. B. Scott 134.*

The writer wishes to express gratitude to Mr. Claude E. Garton, who first brought to attention the occurrence of the species in the Canadian Lakehead, to Dr. James H. Soper, who kindly gave the listing of the collections of the Toronto Herbarium and to Dr. J. B. Carlson, University of Minnesota, Duluth Branch, for adapting the distribution map.—OLGA LAKELA, UNIVERSITY OF MINNESOTA, DULUTH BRANCH.

Prunus americana var. lanata a Synonym of P. nigra.—As originally published, *Prunus americana* var. *lanata* Sudworth (U.S.D.A. Div. For. Bull. **14:** 237, 1897) was a substitute name for *P. americana* var. *mollis* "Torrey & Gray . . . not *P. mollis* Torr." This was in accord with the American Code regulation which treated species, subspecies, and varieties as of equal rank for nomenclatural purposes; the epithet *mollis* could not be used twice in the genus *Prunus*, even though the second use might be in a different category. Sudworth gave no description and no distribution for the plant. Since *P. americana* var. *mollis* T. & G. (Fl. N. A. 1: 407, 1840) and *P. mollis* Torr. (Comp. Fl. N. & Middle States p. 199, 1824) are both taxonomically and nomenclaturally identical (the latter is cited as synonym and basinym for the former, the same differentiating features are stated, and no particular distribution is assigned for either), the "not *P. mollis*" of Sudworth's publication cannot be taken at face value. It meant only that the identical epithet was not to be used in both categories. A year later, Sudworth (Div. For. Bull. **17:** 75, 1898) added a statement of distribution, "Missouri to northern Mexico," which excluded the type region of Torrey's original publication. An emended circumscription is implied, but since no description or reference to a description is given, the emendation is not actually made. If it had been, the newly defined taxon could not bear the name given by Sudworth, because the ultimate type of *lanata* is *P. mollis* Torrey, which for over 60 years has been unanimously treated as a synonym of *P. nigra* Aiton. On the basis of type, then, and regardless of varying applications of the names, *Prunus americana* var. *lanata* and *P. lanata* (Sudw.) Mackenzie & Bush are both synonyms of *P. nigra*. The plant which passes as *lanata* is common in most of Texas, chiefly in limestone areas (in the eastern Pine Belt are forms with thinner and narrower leaf blades, suggesting introgression with *P. umbellata* Ell.). It is certainly not to be referred to *P. americana* Marshall. It is a solitary small tree, not forming thickets from rhizomes; it rarely has spinescent branchlets; the leaf blades are acute to abruptly acuminate, sparsely to densely pubescent beneath even in age; the fruit is purple with a heavy bloom, not red or yellow. I can find no satisfactory grounds for separating it

from *P. mexicana* S. Wats., Proc. Amer. Acad. **17:** 353, 1882, described from northern Mexico (Coahuila). Detailed information on the northeastern limit of this species, and possible introgression with others, must await local studies in the Ozark and Mississippi Valley regions.—Lloyd H. Shinners, southern methodist university, dallas, texas.

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Hedyotis rosea in Arkansas.[1]—On March 20, 1953, collections of *Hedyotis rosea* Raf. were made from scattered patches in the low fields and lawns at Conway, Faulkner County, Arkansas.

The plants had large pink corollas, ranging in length from 7.5 to 12.5 mm. and with length of corolla tubes ranging from 4–7 mm. The calyx length ranged from 2.5–4 mm. with lobes 0.25–0.5 mm. in length. The throats of the corollas were hairy. The seeds were about 1 mm. long and 0.2–0.3 mm. wide. The upper surfaces of the corolla lobes were densely clothed with minute, short, flat, broad-based enations easily seen with magnification. The basal leaves were spatulate. The joined stipules were almost truncate, to rounded, to very short- and broadly-triangular at the summit.

Originally described by Rafinesque[2] from Louisiana (probably), *Hedyotis rosea* has recently been reported from Oklahoma by U. T. Waterfall.[3] This evidently is the first report from Arkansas.—Jewel E. Moore, arkansas state teachers college.

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Note on Echinochloa muricata.—In a recent issue of this journal (Rhodora **58:** 48. 1956) Fairbrothers indicates that the correct binomial for the indigenous barnyard grass is *Echinochloa muricata* (Beauv.) Fernald. This conclusion appears to be correct, but there are some errors in citations of authority among the binomials he cites as synonyms.

As the author has indicated, the first legitimate use of the epithet *muricata* for this taxon was by Beauvois, who published the binomial *Setaria muricata* in 1812. According to Art. 81

[1] Contributions from the Botanical Laboratory, the University of Tennessee, N. Ser. 174.

[2] Rafinesque, C. Florula Ludoviciana 77. 1817.

[3] Waterfall, U. T. The Identity of *Hedyotis rosea* Raf. Rhodora. **55:** 201–203. 1953.

of the Stockholm Code, this must be considered as the starting date for the epithet for purposes of priority. In 1829 Kunth made the combination *Oplismenus muricatus* which was, in effect, a transfer of Beauvois' epithet. The corrected synonymy for this taxon, as far as the epithet *muricata* is concerned, is as follows:

*Panicum muricatum* Michx. 1803. *non* Retz. 1786.
*Setaria muricata* Beauv. 1812.
*Oplismenus muricatus* (Beauv.) Kunth 1829.
*Echinochloa muricata* (Beauv.) Fern. 1915.

To place the name of Michaux in parenthesis, as the original author, gives an erroneous impression. As pointed out above, the epithet under discussion dates from 1812 when Beauvois used it in combination with *Setaria*. When *muricata* is used for this taxon, but in combination with other generic names, the citation of authority should show Beauvois (in parenthesis) as the original author. As long as the Homonym Rule stands in its present form, it is important for purposes of priority that care be used in the citation of authorities for those names containing an epithet which had been previously used for the same taxon but in an illegitimate combination.—John R. Reeder, Yale University, New Haven, Conn.

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Scientific Books, Libraries and Collectors:—For a long time few people seemed to be very much interested in the history of science. Of late years, due primarily to the efforts of a few devoted scholars, the study of science history has taken on a new air of respectability. The price that is paid for respectability, however, in this study as in all others, is the production of a flood of books on the subject—a few outstanding, most tolerable, and a few poor. Even the worst, to be sure, have some value, but their faults need to be kept constantly in mind lest error and omission take on the cloak of verity.

In 1954 there was published a book of some 300 pages entitled "Scientific Books, Libraries and Collectors," and subtitled "A Study of Bibliography and Book Trade in Relation to Science."[1] The authors, J. L. Thornton and R. L. J. Tully state in their preface that they have "endeavored to record the chief writings of every prominent scientific author . . ." They modestly add that "the professional historian of science will find little new in these pages, but the student of the subject, and the scientist searching for 'bibliographical gaps,' will find between

[1] The Library Association London.

two covers an accumulated wealth of material on the bibliography of science."

This book, it must be admitted, reads easily and pleasantly, as long as one has only a vague acquaintance with the subject. When, however, a botanist reaches page 127 and reads that the 10th edition of Linnaeus' "Systema Naturae" (1758–59) is "of special significance because it has been taken as the basis of modern botanical and zoological binomial nomenclature," he is inclined to be somewhat amazed—and amused. He is perhaps inclined to think that the "Hortus Cliffortianus" (1737) and "Genera Plantarum" ed. 5 & 6 (1754 & 1764), which are not mentioned, are of somewhat more importance than the "Classes Plantarum" (1738) and "Flora Suecica" (1746 & 1755), which are mentioned.

At page 165 one is surprised to be told that Bentham and Hooker's "Genera Plantarum" is a mere compilation—an assertion which, if true, would indicate that this great work was considerably less valuable than it in fact is. At page 213 one is told that the "Index Kewensis" is considered to be a bibliography—one thing that it is not! One wonders why, if this, the standard nomenclator for post-Linnaean botany, is included, we do not find mention of Tournefort's "Institutiones Rei Herbariae" or Caspar Bauhin's "Pinax Theatri Botanici," two of the important pre-Linnaean nomenclators. For that matter, one wonders why Richter's "Codex Botanicus Linnaeanus," which collects the botanical material from the Linnaean publications as well as providing an extensive bibliography of both the Linnaean titles and the pre-Linnaean titles, was omitted. One is distressed to find that no reference is made to J. Christian Bay's critical "Bibliographies of Botany"—surely one of the most important bibliographies that we have.

Mention is made of Pritzel's "Thesaurus . . ." but notice is given neither to Jackson's "Guide to the Literature of Botany . . ." nor Zuchold's various botanical bibliographic titles, all of which supplement Pritzel. Some other notable, and unforgivable, omissions which may be mentioned are "The Catalogue of the Library of the Royal Botanic Gardens, Kew" and its Supplement; Merrill and Walker's "Bibliography of Eastern Asiatic Botany" and Nissen's "Die Botanische Buch Illustration" both of which are copiously annotated. Likewise, the sales catalogs of the German firm of Junk are omitted. For that matter, the catalogs of any of the larger firms dealing in antiquarian natural history books are mines of information for the bibliographer. Abstracting journals, which are certainly useful bibliographic tools, also come off badly. "Botanical Abstracts" and its successor "Biological Abstracts" seem to have escaped the authors' notice. Absent also is reference to the very useful United States Department of Agriculture publication "Bibliography of Agriculture." Also among the missing is the "Journal of the Society for the Bibliography of Natural History." Finally, we note the omission of the "Union List of Serials," a work which lists the library holdings of upwards of 120,000 titles in the United States and Canada.

The next to the last chapter deals with "Scientific Publishing and Bookselling." Despite the subtitle of the book, one finds here very little about the book trade. The house of Caxton receives some discussion, and a few continental publishers of that period are mentioned. We look in vain for mention of the house of Plantin. Longmans, John Murray, and Macmillan are mentioned but we search without success for Lovell Reeve & Co., Wilhelm Engelmann, or Martinus Nijhoff. In the United States, only D. Appleton & Co. and McGraw-Hill Book Co. are considered worthy of note. No mention is made of the various university presses which here carry on so much of the scientific publication today. Finally, and rather importantly, no mention is made of the several presses which are responsible for the production of technical journals.

The final chapter, "Scientific Libraries of Today," vies with the preceding for the title of "worst chapter in the book." Only Great Britain and the United States are considered at all, and the latter very superficially. We are told of the destruction, during the last war, of the library of the Manchester (England) Literary and Philosophical Society. No mention is made of the destruction of the library of the Botanical Museum at Berlin-Dahlem or the other scientific libraries in that city. We are told of the libraries at Kew and the British Museum (N. H.), but no mention is made of the library of the old Royal Botanic Garden at St. Petersburg (now Leningrad), though its catalog receives brief mention. Nor does the splendid library at the Conservatoire Botanique in Geneva receive recognition. For this country, no mention is made of the great holdings of natural history books at the University of California, at Harvard, and at the United States Department of Agriculture—to mention but three.

This review deals with only a small portion of the field that Thornton and Tully claim to have covered. All in all, they have not done so good a job as one might have hoped—or as other reviews would lead one to expect. True, within its limitations, the book contains a great deal of information and is, therefore, of considerable value. Most of the sins committed are those of omission—but each fact and figure needs to be checked carefully before it is quoted.—Gordon P. DeWolf, Jr., Bailey Hortorium, Cornell University.

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# REAPPRAISAL OF TWO PLUMOSE RHYNCHOSPORAS OF THE SOUTHEASTERN UNITED STATES

R. B. Channell

*Rhynchospora*, Section Eurhynchospora, in Canada, the United States and the West Indies, was treated taxonomically by Gale (Rhodora **46:** 89–278.) in 1944. According to this revision, Series Plumosae consists of three species: *R. plumosa* Ell., *R. intermedia* (Chapm.) Britt. and *R. oligantha* Gray, all characterized by the possession of unique perianth bristles. *Rhynchospora oligantha* var. *breviseta* Gale was originally described in this work.

This new variety was distinguished from *R. oligantha* var. *oligantha* (as var. *typica*) by the reduced condition of the perianth bristles to less than one-half the length of the achene, the ovoid shape and smaller size of the achene and the short-conic tubercle. At this time the ranges of the two varieties were considered to be mutually exclusive: var. *oligantha* was reported to occur along the Atlantic and Gulf Coastal Plain from New Jersey southward into Georgia and western Florida, thence westward into eastern Texas (and also in Central America); var. *breviseta* was reported from peninsular Florida, western Cuba, Jamaica and Hispaniola.

In the treatment of the same group (Sect. Plumosae), Kükenthal (Bot. Jahrb. **74:** 505–509. 1949.) recognized three species also. However, only two of these had been recognized as such by Gale. Accordingly, *Rhynchospora intermedia* was reduced to varietal status under *R. plumosa*, where, in addition, the new variety *interrupta* Kükenth. appeared. The plumose-

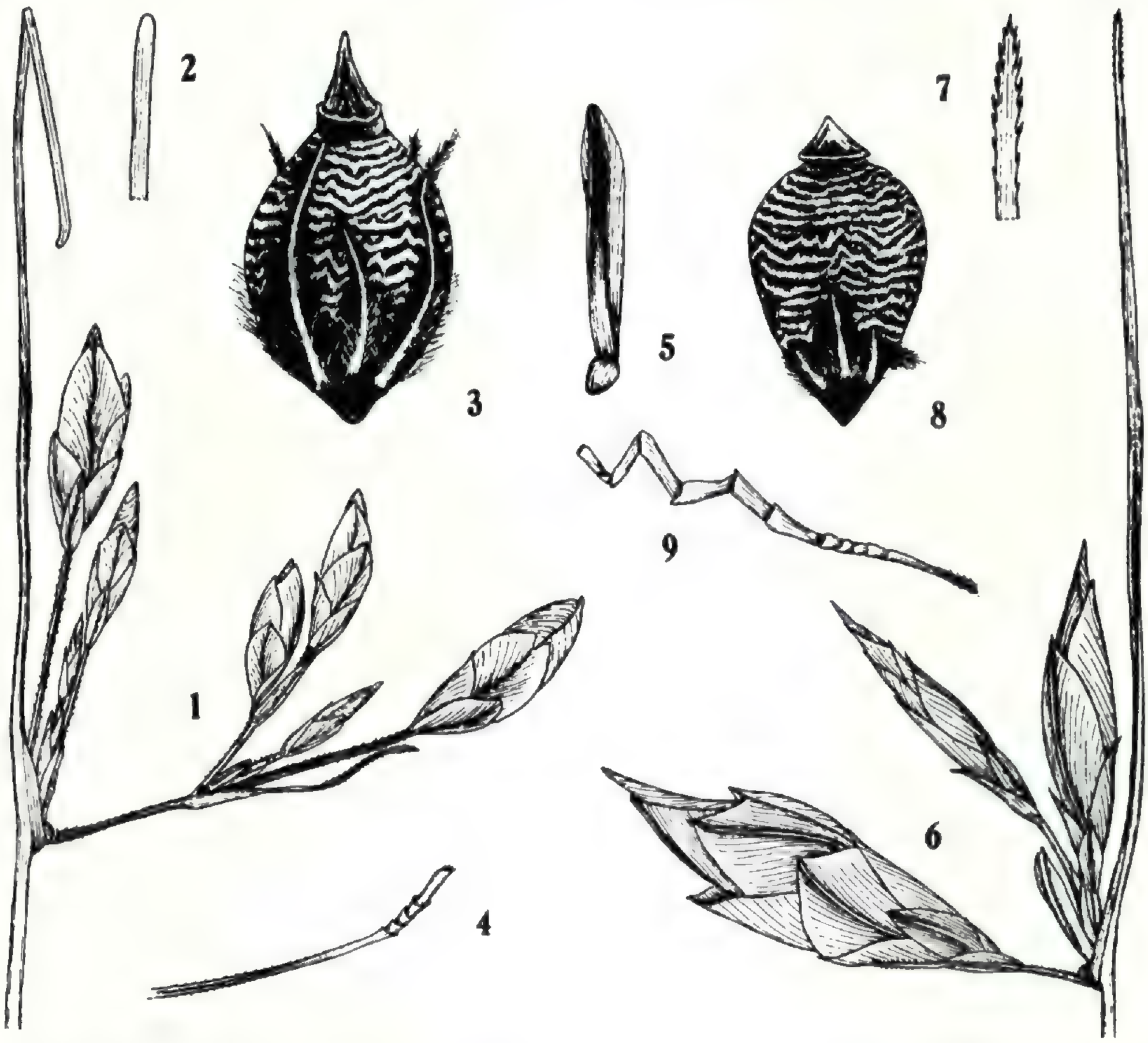
bristled *R. diadon* (Nees) Griseb. (*R. lunata* Griseb.), in effect excluded by Gale from Eurhynchospora largely on account of its "curious horned tubercle" (cf. Rhodora **46:** 95. 1944.), was re-instated in the Plumosae. *Rhynchospora oligantha* var. *oligantha* and var. *breviseta*, however, were maintained without change of status or extension of range.

Material collected since the appearance of Gale's monograph and which was not utilized by Kükenthal reveals that *Rhynchospora oligantha* var. *breviseta* is not only morphologically quite distinct, but that its geographical range is sympatric with that of the typical variety over a considerable area. In some areas, in fact, the two are known to occur side by side in the field and, although apparently flowering and fruiting over the same general period, maintain their distinctive morphological features without any indication of intergradation. This evidence, presented in detail below, is considered to be of sufficient magnitude to require the elevation of var. *breviseta* to specific status. The following change of status is thus made:

**Rhynchospora breviseta** (Gale) stat. nov. based on *Rhynchospora oligantha* A. Gray var. *breviseta* Gale, Rhodora **46:** 129, 130. 1944.

The close relationship of *Rhynchospora breviseta* and *R. oligantha* is not questioned. The two species have in common the rugulose achenes, plumose perianth bristles, filiform leaves and culms and the cespitose habit of Series Plumosae. In addition, they have both axillary and terminal inflorescences of 1–several pedicellate spikelets, the inflorescences being both pedunculate and sessile and the spikelets disposed singly or as decompound fascicles. Both species are perennial by means of short, firm or ligneous, somewhat bulbous, crown-like rhizomes. The lowermost leaves consist of closed, truncate sheaths which may or may not bear short, greatly reduced blades. The typical cauline leaf is comprised of a closed, slenderly cylindric sheath, truncate at the apex, and a long, linear blade about ½ or ⅓ the width of the sheath. The blades are more or less concave or channeled throughout the serrulate basal portion and subterete or obtusely 4-angled and entire above.

The leaf tips differ according to the species: *R. oligantha* (Fig. 2) has entire, blunt-tipped leaves; *R. breviseta* (Fig. 7)




RHYNCHOSPORA OLIGANTHA (*Channell 3120*): Fig. 1, terminal inflorescence × 4; Fig. 2, leaf tip × 12; Fig. 3, achene × 12; Fig. 4, rachis × 4. R. BREVISETA (*Channell 3257*): Fig. 5, prophyll × 8; Fig. 6, terminal inflorescence × 4; Fig. 7, leaf tip × 12; Fig. 8, achene × 12; Fig. 9, rachis × 4. (Drawings kindly prepared by Ding Hou.)

has acute tips which are minutely serrulate on the margin. These differences have been previously overlooked. While generally representing a practical taxonomic character, it should be pointed out that the serrulations of the leaf tips of *R. breviseta* are so minute that they are sometimes obscured in herbarium material which has been prepared by gluing the specimens to the sheets. The glue acts to seal these minute teeth against the margin of the leaf causing the margin to appear entire or otherwise rendering the serrulations somewhat transparent and thus difficult to observe.

The achenes of *Rhynchospora oligantha* and *R. breviseta* are more nearly lenticular than those of the other members of Series Plumosae. Despite this general similarity, however,

the two species are remarkably distinctive on the basis of other achenial features. The achene of *R. oligantha* (Fig. 3) is broadly elliptic and has a conspicuous collar-like constriction at the apex, the upper flange of which surrounds the base of the conic-attenuate tubercle. The achene of *R. breviseta* (Fig. 8) is ovoid or obovoid in shape and is crowned by a depressed-conic tubercle giving the appearance of having been applied to the apex of the achene. Indeed, the achenial differences are so pronounced that there is little chance of confusing the two species on that basis alone.

The achenes of both species have been observed occasionally to be covered with a whitish, waxy bloom, although this is by no means a general feature of herbarium material. This pruinose condition is very conspicuous in freshly collected specimens but may disappear in the process of drying the specimens, especially if artificial heat is employed. There is considerable variation in the color of the achenes, this apparently varying to a certain extent with the degree of maturation attained. In individual spikelets of *R. breviseta*, which are oftentimes 8-fruited, the achenes may vary in color from manila-buff in the terminal portion of the spikelet, to castaneous in the central portion and, finally, dark blue or bluish black in the basal portion. The achenes are usually promptly shed at maturity; thus the dark-colored achenes are not often to be seen on herbarium sheets.

As the epithet connotes, the plumose perianth bristles of *Rhynchospora breviseta* are considerably shorter than those of *R. oligantha*. In the latter species the bristles vary from ½ the length of the achene to slightly longer than the achene, the basal portion being heavily plumose and the tips antrorsely serrulate; in the former the bristles are less than ½ the length of the achene and usually lack the antrorsely serrulate tips so pronounced in *R. oligantha* and are occasionally reduced to mere plumose tufts.

While there is a decided difference between *Rhynchospora breviseta* and *R. oligantha* in the size and shape of the spikelets where best developed, the considerable variation throughout the geographical ranges of the two species precludes the use of these as diagnostic characters. Nevertheless, the spikelets

of *R. breviseta* (Fig. 6) are, in general, longer and more slenderly fusiform in shape, the surface of the spikelet being somewhat torulose due to the arrangement of the 3–8 achenes in a scarcely imbricate, spiral series along the sides of the anfractuose rachis. This spirally zigzag, somewhat winged rachis is a conspicuous feature of *R. breviseta* (Fig. 9) even after the achenes are shed. Varying from 5 to 8(–10) mm. in length, the rachis remains intact well after the shedding of the spikelet scales and the achenes, even though it is a weakly organized, brittle structure which breaks easily under mechanical stress. The spikelets of *R. oligantha* (Fig. 1) are usually only 1–2(–3)-fruited, terete and relatively smooth, with little or no tendency to be torulose. The rachis (Fig. 4) is generally short and straight, somewhat clavate, 1–2(–3) mm. in length and without evident wings.

The following key summarizes the numerous differences between the two species:

Achene elliptic, broadest near the middle, the apex constricted into conspicuous collar-like flange; tubercle conic-attenuate, arising out of the surrounding collar, not contracted at the base; perianth bristles exceeding one-half the length of the achene; spikelets few-flowered, 1–3-fruited, the rachis with short, congested internodes; divergent lower branch of well-developed inflorescence commonly bearing a secondary branch, each with a pulvinate bract in the axil; leaf tips obtuse, entire ..... *R. oligantha.*

Achene obovoid, broadest above the middle, the apex without a conspicuous collar-like flange; tubercle depressed-conic, abruptly contracted at the base; perianth bristles one-half the length of the achene or shorter; spikelets several-flowered, 3–8-fruited, the rachis anfractuose-elongate, the internodes produced between the achenes; divergent lower branch of well-developed inflorescence usually simple, thus with only one pulvinate bract; leaf tips acute or acuminate, minutely serrulate ..... *R. breviseta.*

The collections of *Rhynchospora breviseta* cited below are in addition to those included by Gale and Kükenthal. North Carolina: Brunswick County, *Wood & Clement 7063* (duke, gh); Craven County, *Wood & Clement 6997* (gh). Mississippi: Jackson County, *Channell 3208, 3257 & 3663* (gh, duplicates to be distributed).

*Rhynchospora breviseta* was not previously known to occur in the United States outside of Florida, and these collections extend the range of the species northward into North Carolina

and westward into Mississippi, well into the range of *R. oligantha* in both directions. It is a significant fact that the writer's number *3257* originally comprised a large collection of a mixture of *R. breviseta* and *R. oligantha*. Material of the latter species was segregated only after examination in the laboratory to comprise his number *3258*. This information is presented as unequivocal evidence that the two species occur together in the field, at least in Jackson County, Mississippi.

Even though an inconspicuous element in the flora, without doubt having generally been passed unnoticed, *Rhynchospora breviseta* is to be expected to occur elsewhere on the Atlantic and Gulf Coastal Plain. Future collecting is likely to result in the discovery of the species over an even wider range as well as in areas between those already reported.

Differences in the structure of the inflorescences of *Rhynchospora oligantha* and *R. breviseta* mentioned in the preceding key apparently have been generally overlooked. Except in terms of general form, in fact, the details of inflorescence structure appear nowhere in the genus to have been adequately described. The remainder of this paper is therefore devoted to the description and comparison of the inflorescences of these and related species. In terms of relating species and species groups it would appear that the inflorescence may yield characters which could serve to supplement those of the fruit upon which the taxonomy of the entire genus has been thus far so singularly dependent.

Although of the same fundamental structure, both lateral and terminal inflorescences are produced by the two species in question. Both types are clearly reduced forms of a more extensive and open prototype, as suggested by a comparison with the inflorescences of other species. In addition, *Rhynchospora oligantha* and *R. breviseta* themselves exhibit in a variety of stages a remarkable reduction series. This series strongly suggests the course of the reduction process. In general, the inflorescences of *R. breviseta* (Fig. 6) have undergone reduction to a greater degree than those of *R. oligantha* (Fig. 1) and the two species can usually be distinguished on this basis.

The lateral inflorescences (not figured) are borne on long, flattened, upwardly serrulate peduncles arising singly out of

the closed leaf-sheaths of the mid and lower culm. In their simplest form these consist of a single ebracteate or bracteate spikelet. Frequently, however, the lateral inflorescences are compound and consist of fascicles of pedicellate spikelets. In such cases each fascicle is subtended by a 1-nerved, somewhat vaginate, keeled bract, serrulate at the apex. In compound inflorescences each of the component pedicellate spikelets is, in turn, subtended by an additional (ultimate) bract of distinctly scarious texture (Fig. 5). These ultimate bracts would appear to correspond to the prophylls of grasses. Ranging in length from 3–5 mm., these thin, glabrous, ultimate bracts are more or less oblong in shape and have obtusish apices. Each is longitudinally 2-nerved, one nerve being located on each of the two keels of the convex back. The basal portion of the blade of each of these bracts ensheathes the pedicel it subtends. Structurally, the lateral inflorescences thus possess only two orders of bracts: those of the inflorescence fascicles and those of the individual pedicellate spikelets.

The terminal inflorescences differ from the lateral in being sessile, that is, in lacking a common peduncle. Thus each, regardless of the degree of branching, is brought into close proximity to the uppermost leaf. This leaf is regarded as the primary (lowermost) bract of the terminal inflorescence-system, although it is little modified as compared with ordinary cauline leaves. The sheath portion is open, distinctly vaginate and thin-margined; the blade portion is concave and, although not rendered in the accompanying drawings, is minutely serrulate on the margin at the base, becoming entire above and finally indistinguishable from typical leaves toward the tip. The retention by the primary bract of foliar features characteristic of ordinary leaves renders it easily distinguishable from the highly modified, distinctly keeled bracts which often subtend each fascicular unit of the inflorescence. Appearing to be a continuation of the culm, the primary bract is to each over-all terminal inflorescence-system morphologically comparable to the bract subtending each individual inflorescence-fascicle. The terminal inflorescences may thus possess bracts of three orders, as shown in Figure 1, the primary bract just described in addition to the two types described for and common to the lateral, axillary

inflorescences. Bracts of secondary order may sometimes be absent altogether.

In compound inflorescences the lower branch is commonly and characteristically lateral in position and bears a conspicuous tuberculate enlargement (Figs. 1 & 6) in its axil. This pulvinate structure is clearly related to the lateral position ultimately assumed by the lower branch, in growth or enlargement doubtless serving to expand the inflorescence. Of more or less callous tissue, this pouch-like process is morphologically appendicular, belonging to the ultimate bract (Fig. 5) (prophyll) of the inflorescence, that is, the bract immediately subtending the individual pedicellate spikelets. For each inflorescence, however, only (0–)1–2 of these bracts bear such a process. As clarified in the accompanying key, the two species in question usually differ in this respect: *Rhynchospora oligantha* often bears two such bracts to each of the more well-developed inflorescences; *R. breviseta* usually bears only one.

There is considerable variation among the inflorescences as to the degree of development, even in the same collection or individual clump. The most fully developed inflorescence is of a characteristically corymbiform type, the primary axes of which may be twice or thrice branched. In less well developed inflorescences the primary axes are simple, arranged in a sort of umbellate cluster. Due to the failure of certain spikelets to develop, there are often present more ultimate bracts (prophylls) per inflorescence-fascicle than spikelets, for the bract subtending each pedicel is oftentimes produced whether the spikelet develops or not. Those inflorescences in which only the lateral axis develops owe their unilateral form to the retention of an axillary bract bearing a tuberculate process at the base. Occasionally the axillary inflorescences are severely reduced, represented merely by a single pedicellate, ebracteate spikelet. This condition, however, is less common than the others described and is usually associated with a more basal position of the spikelet on the culm.

The inflorescences of *Rhynchospora oligantha* and *R. breviseta* are quite unlike the more congested, spiciform or glomerate inflorescences of *R. plumosa* (including var. *interrupta*) and *R. intermedia*, the two pairs of species usually being separable

in the field on this basis. This is due to the distinctly pedicellate nature of the spikelets of the former pair as contrasted with the subsessile nature of the spikelets of the latter. Of the plumose-bristled Rhynchosporas, the inflorescences of *R. oligantha* and *R. breviseta* find their closest match in those of *R. diadon* which has only terminal inflorescences. Although more extensively branched and more floriferous, but in general more compactly corymbiform, the inflorescences of this species are nevertheless very similar to those of *R. oligantha* and *R. breviseta* in structural detail. The bracts associated with the inflorescence are of three orders, one of the ultimate, axillary bracts of each inflorescence-fascicle being dorsally spurred or pulvinate. The pattern of branching is identical and the lowermost branch of each inflorescence-fascicle assumes a lateral or divergent position. From this standpoint, therefore, the inflorescence of *R. diadon* suggests a logical prototype of *R. oligantha* and *R. breviseta*. The similarities in the structure of the inflorescences of these three species represent an additional correlative characteristic, not previously emphasized, which favors the retention of *R. diadon* in the Plumosae.

In fundamental details of structure and especially in general appearance, the inflorescences of *Rhynchospora oligantha* and *R. breviseta* are quite comparable to those of *R. rariflora* (Michx.) Ell., although the latter belongs to a different series (Rariflorae) which lacks plumose perianth bristles. In the field, therefore, it is often more difficult to distinguish *R. rariflora* from *R. oligantha* and *R. breviseta* than to distinguish the latter two species from *R. plumosa* and *R. intermedia*.—HARVARD UNIVERSITY, CAMBRIDGE, MASS.

# THE GENUS PETERIA (LEGUMINOSAE)[1]

C. L. Porter

## History of the Genus

The North American genus *Peteria* was established by Asa Gray[2] in 1852, and named in honor of Dr. Robert Peter who had been active in research on the flora of Kentucky. The genus was based on a single species, *Peteria scoparia* A. Gray, typified by collections made by Wright in Trans-Pecos Texas in 1849 and in southern New Mexico in 1851, and a collection made by Wislizenus in Chihuahua in 1846. Gray referred the genus to the tribe *Galegeae* and indicated that it was distinct from other genera of that tribe because of the stipules consisting of a pair of divaricate prickles like those found in the genus *Caragana*, and because of the "aspergilliform" style and stigma, terminated by a tuft of hairs, this latter feature reminding him of the genus *Lessertia*.

The genus was accepted by Bentham and Hooker[3] in 1865, who placed it in the *Galegeae* between *Lamprolobium*, a genus found in Australia, and *Barbieria*, a genus of tropical South America. These authors, however, erroneously described the stipules as being "subulate," and they also misrepresented the plants as being "glabrous" and the "stylus inflexus, apice sub stigmate circumcirca barbatus, stigmate capitato terminali."

In 1873 Sereno Watson[4] added another species, *Peteria Thompsonae*, based on specimens collected in southern Utah in 1872 by Mrs. Ellen P. Thompson (sometimes erroneously written as "Mrs. A. P. Thompson"), the sister of Major John Wesley Powell of Colorado River fame whose headquarters at the time were at Kanab, Utah.[5]

In 1876, J. G. Schaffner collected additional specimens of the genus near San Louis Potosi, Mexico, and noted that the thick, tuberous roots of the plants were eaten by the natives there

[1] Contributions from the Department of Botany and the Rocky Mountain Herbarium, University of Wyoming, No. 228.

[2] Pl. Wright. **1**: 50. 1852.

[3] Gen. Pl. **1**: (2): 495. 1865.

[4] Am. Nat. **7**: 300. 1873.

[5] see Ewan, J. A., Rocky Mountain Naturalists. University of Denver Press, p. 321. 1950.

who called them "camote del monte," or mountain sweet potato; and in 1878 Parry and Palmer secured additional specimens from the same region. Based on these collections, *Peteria scoparia* var. *glandulosa* A. Gray was published by Sereno Watson[6] in 1882. It was noted that these plants bore a resemblance to *Peteria scoparia*, but were much more viscid-glandular on the calyx and pedicels.

The genus was taken up by P. Taubert[7] in his treatment of the family in Die natürlichen Pflanzenfamilien where it was placed in the tribe *Galegeae*, subtribe *Tephrosiinae*. Taubert described the genus as being monotypic, and credited *Peteria scoparia* to New Mexico only. The species was illustrated by an excellent small figure in the text.

There the matter stood until 1923, when P. A. Rydberg[8] published an account of the genus in which he raised var. *glandulosa* to specific rank, bringing the total species to three. Rydberg placed the genus in the tribe *Galegeae*, subtribe *Craccanae* (the same as the subtribe *Tephrosiinae*), in sequence after *Galega* and *Cracca* (*Tephrosia*), the three genera in the North American Flora included in that subtribe.

Ivar Tidestrom[9] published *Peteria nevadensis* in 1923 on the basis of plants collected by him near Las Vegas, Nevada, in 1919, which were supposed to possess characters similar to those of *Peteria Thompsonae* but with smaller size of plants and flowers and narrower calyx-lobes. These differences given by Tidestrom were not convincing, being quantitative rather than qualitative, and it has been found that they fit well within the general pattern of variability of *Peteria Thompsonae*. Furthermore, the populations in Utah and Nevada and adjacent Arizona occupy a continuous area and very similar ecological situations.

The present writer became interested in the genus while engaged in a study of Nevada legumes in the course of which it became necessary to compare the types of the above two names, and to examine all the material that could be found of these plants in the larger herbaria. It seemed worthwhile to explore the remainder of the genus, particularly when it was discovered

[6] Proc. Am. Acad. **17**: 342. 1882.
[7] Engl. & Prantl, Nat. Pflanzenfam. III. Abt. 2, 267, 273. 1894.
[8] N. Am. Fl. **24**: (3): 183–184. 1923.
[9] Proc. Biol. Soc. Wash. **36**: 183. 1923.

that an apparently undescribed species has been unrecognized for a number of years.

## General Morphology

ROOTS. The root system of the genus *Peteria* is imperfectly known, being present on herbarium specimens of only two of the species, *P. Thompsonae* and *P. glandulosa*, in both of which there is a thickened tuberous root which is deep-seated, tapering above and below. In the other two species, *P. scoparia* and *P. pinetorum*, it is presumed that a similar root type occurs, but no specimens showing this feature have been found, the plants having invariably been broken off above the level of such tubers. Kearney and Peebles[10] have noted "the tuberous rootstocks of *P. scoparia*, known in Texas as camote-de-monte, are reported to be edible," but that statement probably was taken from Gray's description of *P. scoparia* var. *glandulosa* (treated hereafter as *P. glandulosa*), and Gray in turn derived it from the label on *Schaffner 834* which became the type of Gray's variety. The fourth species, *P. pinetorum* described below, is based on several duplicates of a single collection, none of which shows the roots.

STEMS. The stem is that of a typical herbaceous perennial arising from a somewhat lignescent base. In *P. scoparia* the stems are erect and usually bushy-branched from near the base, rounded in cross section, and longitudinally striate. In *P. Thompsonae* the stem is erect and branched above, but usually single below. *P. glandulosa* is a low bushy plant with stems erect or often decumbent and sprawling, branching from near the base. The greatly elongated stems of *P. pinetorum* are weak and with elongated internodes, attaining a height of 1 m. or more.

LEAVES. In all species the leaves are petiolate and odd-pinnate with several to many leaflets. In three of the species, *P. scoparia*, *P. glandulosa*, and *P. pinetorum*, the leaflets are more or less similar, small and numerous, and narrowly oblong to elliptic in outline. In *P. scoparia* alone the leaflets are readily deciduous from the rachises, and in late summer or during dry periods the plants take on a characteristic broom-like appear-

[10] U.S.D.A. Miscel. Publ. 423: 465. 1942; Ariz. Flora 441. 1951.

ance which suggested the name given them by Gray. In the other species the leaflets are persistent. *Peteria Thompsonae* has much larger leaflets which are rounded or retuse at the apex and oval to obovate in shape, much like those of several species of *Astragalus* found in the same area.

STIPULES. The stipules in all species consist of a pair of stiff, sharp, slender prickles which are widely divaricate, 2–10 mm. long, and stramineous or brownish in color.

PUBESCENCE. The plants show varying degrees of pubescence, but all have the same type of hairs which are simple, basifixed, somewhat flattened, mostly pure white in color, and appressed. The pubescence is usually more abundant on the margins of the leaflets and on their veins below. There is a tendency for the species to produce glandular hairs on the pedicels and calyx, this being best developed in *P. glandulosa*.

INFLORESCENCE. The inflorescence is a narrow raceme of varying length, arising either terminally or opposite the leaves, never axillary. The flowers are subtended by narrow subulate bracts, and there are no bracteoles. There seems to be a general tendency, except in *P. Thompsonae*, for a number of the flowers to abort or drop off, leaving flowerless gaps in the inflorescence and often only a few fruits.

CALYX. The calyx consists of two parts: a tubular portion which is cylindric-campanulate and slightly gibbous at the base above, and five somewhat unequal lobes which are deltoid-acuminate to narrowly lanceolate-acuminate, these lobes the same length as the tube or shorter, and the two upper ones united farther up than the three lower ones. The calyx is not much changed after anthesis.

COROLLA. The corolla is papilionaceous, and the petals are long-clawed, the claws very slender and as long as the blades or a little shorter. The banner is strongly folded lengthwise and its sides are reflexed. The wings are somewhat smaller than the banner and slightly auricled. The keel petals are a little shorter than the wings, and they have a broad auricle at the base of the blade. The color of the corolla is white to ochroleucous or tinged with purple; in *P. Thompsonae*, at least, the keel is maculate.

STAMENS. The stamens are diadelphous, nine of them with

their filaments fused into a cylindric tube, the upper one entirely free. The anthers are all alike, 2-celled, and oblong.

PISTIL. The pistil is unicarpellate, short-stipitate or subsessile, the ovary laterally flattened and without any intrusion of sutures, several-ovuled, the style bent upward and with a widened basal portion which at length becomes hardened, horny, and spirally twisted, the stigma a tuft of short hairs surrounding the apex of the style and slightly oblique.

FRUIT. The fruit is a legume which is linear or narrowly oblong, nearly straight, slightly if any constricted between the seeds or at places where ovules have aborted, laterally flattened, subsessile or with a stipe up to 5 mm. long in *P. pinetorum*, few-seeded, dehiscent along both sutures.

SEEDS. The seeds are rounded-oblong and flattened, the funiculus attached near the end. They are not strophiolate.

## Cytology

Nothing is known concerning the cytology of this genus. It is not mentioned in the works of Chekov[11] nor of Senn.[12] An attempt to germinate a few seeds taken from herbarium specimens was unsuccessful and no root tips were obtained. In discussing relationships in the legumes, Senn (l.c.) makes the statement that the evidence of both Chekov and himself indicates that the tribes *Hedysareae*, *Galegeae*, and *Genisteae* are highly heterogeneous assemblages with relatively little relationship.

## Acknowledgment

The following herbaria have provided material for this study, for which grateful acknowledgment is made: The Gray Herbarium, Harvard University (GH); U. S. National Herbarium (US); U. S. National Arboretum Herbarium (NA); Missouri Botanical Garden (MO); Chicago Natural History Museum (F); University of Arizona (ARIZ); Rocky Mountain Herbarium, University of Wyoming (RM).

## Taxonomy

**Peteria** A. Gray, Pl. Wright. **1: 50**. 1852; Bentham & Hooker, Gen. Pl. **1** (2): 495. 1865; Taubert in Engl. & Prantl, Nat. Pflanzenfam. III. Abt. 3, 273. 1894; Rydberg in N. Am. Fl. **24** (3): 183. 1923.

Erect or sprawling herbs from a deep tuberous root. Leaves odd-

[11] Bull. Soc. Nat. Mosc. Biol. 46 (4): 233–240. 1937.

[12] Bibliog. Genet. 12: 175–336. 1938.

pinnate, 7–many-foliolate, without stipels, the stipules a pair of slender divaricate prickles. Flowers in terminal racemes or sometimes the racemes lateral and then opposite the leaves, not axillary, papilionaceous, on short pedicels, subtended by subulate bracts, ebracteolate. Calyx cylindric-campanulate, slightly gibbous at the base above, unequally 5-lobed, the sinus between the two upper lobes shallower than the others. Corolla white or ochroleucous, sometimes tinged with purple, the petals with very slender claws; banner obovate-oblong, moderately to strongly arched, folded lengthwise and the sides reflexed; wings oblong to obovate, somewhat auricled at the base; keel petals obliquely obovate, obtuse, with a broad basal auricle. Stamens 10, diadelphous, the upper one with a free filament; anthers all alike. Ovary sessile or short-stipitate, several-ovuled, the style becoming hardened and twisted at the base and incurved, the stigma a slightly oblique tuft of short hairs on the end of the style. Pod linear or narrowly oblong, straight or nearly so, laterally flattened, little or not at all constricted where ovules have aborted, dehiscent along both sutures. Seeds few to several.

Type species: *Peteria scoparia* A. Gray.

### Key to the Species

Leaflets rounded or retuse at the apex, 5–10 mm. wide, oval to obovate; corolla 15–20 mm. long; Utah, Nevada, and northern Arizona ..... 1. *P. Thompsonae.*

Leaflets acute or at least mucronate-pointed, not more than 5 mm. wide, usually oblong or narrowly elliptical; corolla not more than 15 mm. long; eastern Arizona to western Texas and southward through Mexico.

- Stems about 1 m. high; leaflets 6–12 mm. long, flat; pods 6–7 cm. long; plants of the pine forests of northern Mexico ..... 2. *P. pinetorum.*
- Stems lower, seldom over 6 dm. high; leaflets mostly much smaller, flat or involute; pods shorter; plants of dry plains and hills.
  - Calyx and pedicels strigose or slightly glandular; leaflets early deciduous; stems mostly 5–8 dm. high, with ascending branches; southeastern Arizona to western Texas and south ward to Chihuahua ..... 3. *P. scoparia.*
  - Calyx and pedicels densely glandular; leaflets persistent; stems mostly 1–3 dm. high, with divaricate branches; San Luis Potosi and Zacatecas to Puebla ..... 4. *P. glandulosa.*

### 1. **Peteria Thompsonae** S. Wats.

*Peteria Thompsonae* S. Wats. Am. Nat. **7:** 300. 1873.
*Peteria nevadensis* Tidestr. Proc. Biol. Soc. Wash. **36:** 183. 1923.

Erect and usually several-stemmed from the base, 2–5 (1–6) dm. high, the stems with a few branches near the base, glabrous to sparsely strigose. Leaves odd-pinnate, 7–16 (5–20) cm. long, the rachis usually densely appressed-strigose, bearing 13–21 (11–25) oval or obovate, often slightly

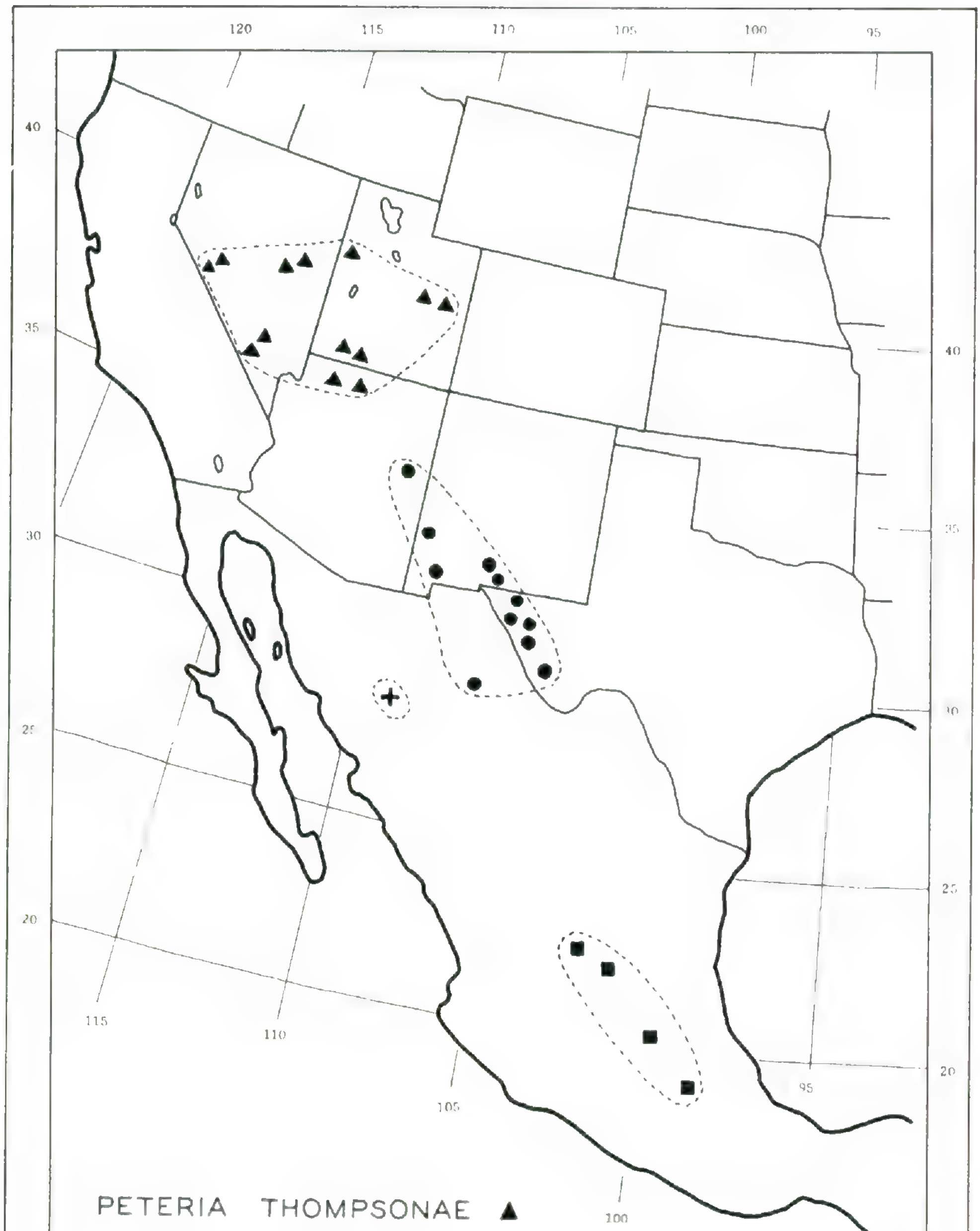



Fig. 1. Map showing distribution of species of *Peteria*.

emarginate leaflets 6–15 mm. long and 4–12 mm. wide, these glabrous to strigose above, strigose beneath, persistent. Stipular spines 2–5 mm. long. Racemes 1–2 dm. long, several-flowered, the pedicels and calyx slightly to moderately glandular-puberulent. Calyx tube mostly 9–10 mm. long, the teeth 7–9 mm. long. Corolla 15–23 mm. long. Pods about 5 cm. long, 5 mm. wide.

TYPE: Kanab, Kane Co., Utah, *Mrs. E. P. Thompson* (A. P. Thompson on label by error), s.n. in 1872 (GH; isotype US; phototype RM).

HABITAT: desert washes and gravelly slopes of dry hills and mesas.

RANGE: southern half of Utah and Nevada and adjacent northwestern Arizona.

SPECIMENS EXAMINED:—**Utah.** Without definite locality: southern Utah, *Capt. F. M. Bishop 160* in 1872 (US), and by the same collector in 1873, s.n. (GH, F). EMERY COUNTY (or possibly GRAND COUNTY): Green River, May 9, 1890, *M. E. Jones* s.n. (MO, US); same locality May 23, 1914, *M. E. Jones* s.n. (RM). GRAND COUNTY: Cisco, May 9, 1890, *M. E. Jones 1676* (ARIZ, RM). JUAB COUNTY: desert shadscale, common in shallow washes, 5,000 ft., 11 miles south of Troutcreek, June 17, 1933, *Maguire & Becraft 2664* (GH, MO, RM, US), and by the same collectors *2665* (MO). KANE COUNTY: Kanab, *Mrs. E. P. Thompson* (A. P. Thompson on label by error) s.n. in 1872 (type GH, isotype US, phototype RM); Kanab, 5,500 ft., May 22, 1894, *M. E. Jones 5286* (US). WASHINGTON COUNTY: Springdale, 4,000 ft., May 16, 1894, *M. E. Jones 5230* (MO, RM, US). **Nevada.** CLARK COUNTY: on mesa 16 miles northeast of Las Vegas, 840 meters, April 23, 1919, *Tidestrom 9083* (type of *P. nevadensis* US, isotypes GH, US, phototype RM). ESMERALDA COUNTY: in wash, base of Montezuma Mt., 1650 meters, June 6, 1919, *Tidestrom 9791* (NA, US). NYE COUNTY: 20 miles southwest of Currant, May 14, 1941, *Eastwood & Howell 9422* (GH, F, US); frequent, shadscale-mixed desert, gravelly-sandy soil, ¾ mile north of Locke's Ranch, May 21, 1945, *Maguire & Holmgren 25127* (ARIZ, MO, NA, photo RM).

## 2. **Peteria pinetorum** sp. nov.

Herba fere 1 m. alta, caulis erectus, gracilis, internodis 2–5 cm. longis; foliis 3–7 cm. longis; foliolis persistentibus, interdum 13–17, 2–3 mm. latis, 6–12 mm. longis, anguste ellipticis vel oblongis, in apice mucronatis; stipulis spinosis, 3–5 mm. longis; racemis fructu plus minusve 1–2 dm. longis; calycibus fructu pubescentibus glandulosis; leguminibus lineato-oblanceolatis, 4–7 cm. longis, 5 mm. latis, stipitibus fere 5 mm. longis; floris ignotis.

Spreading, bushy herb about 1 m. high, with slender, sparingly pubescent stems bearing rather distant leaves, the internodes 2–5 cm. long. Leaves 3–7 cm. long, the leaflets persistent, mostly 13–17, narrowly elliptical or oblong, 2–3 mm. wide and 6–12 mm. long, acutish and mucronate at the tip, short petiolulate, with a prominent purplish-black and strigose midrib and occasional strigose hairs on the margin but otherwise glabrous, the pairs of leaflets 3–5 mm. distant from each other. Stipules a pair of divaricate setose spines 3–5 mm. long. Inflorescence a terminal raceme 1–2 dm. long or more, the upper part of the rachis bearing only distant

awl-shaped bracts when in fruit, the few fruits produced only from its base, the lowest fruit from a leaf-axil. Axis and pedicels moderately glandular-pubescent. Flowers not known. Fruiting pedicels 7–14 mm. (mostly about 10 mm.) long. Fruiting calyx cylindrical, somewhat gibbous at the base, glandular-pubescent, the tube about 6 mm. long, the teeth narrowly lanceolate, about 3 mm. long. Pods linear-oblanceolate, straight, with a stipe about 5 mm. long, the body 4–7 cm. long, the maximum width about 5 mm. Ovules several, and seeds 2–5, oblong, 5–6 mm. long, 3 mm. wide.

TYPE: Los Cascarones, Rio Mayo, Chihuahua, Mexico, *H. S. Gentry 2658* (GH; isotypes ARIZ, F, MO, US; phototype RM).

HABITAT: cool pine slopes at about 7,000 ft. elevation.

RANGE: known only from the western slope of the Sierra Madre Occidental in the Rio Mayo region of western Chihuahua near the Sonora border.

This plant had been identified by Dr. Paul Standley as *Peteria glandulosa* (Gray) Rydb., which is perhaps its nearest relative. It differs greatly from that species, however, in habitat and in general aspect, being the tallest of all species in the genus, and in having larger and less crowded leaflets than in either *P. glandulosa* or *P. scoparia* but of the same general type as in those species. It further differs from *P. scoparia*, a plant of dry plains and foothills, in persistence of leaflets and in lacking the characteristic bushy "broom-like" aspect of that species. It is known only from a single but widely distributed collection which was in fruiting condition and lacked flowers. It is presumed to have the tuberous roots of *P. glandulosa*, but none was found on the specimens.

### 3. **Peteria scoparia** A. Gray

*Peteria scoparia* A. Gray, Pl. Wright. **1:** 50. 1852.

Stems bushy, 5–10 (mostly about 6) dm. high, the numerous branches ascending or somewhat divaricate, glabrous or nearly so, pale green and striate, up to 5 mm. thick at the base. Leaves 5–10 cm. long, with a slender, persistent rachis bearing 9–15 narrowly elliptic to oblong, mucronate leaflets 3–6 (2–11) mm. long and 1–2 mm. wide, the leaflets usually deciduous to give the plants a characteristic broom-like appearance during the dry season, glabrous except on margin above, strigose beneath, acutish and mucronate at the apex, the pairs of leaflets mostly 3–5 mm. distant from each other. Stipules a pair of divaricate setose spines 3–5 (2–6) mm. long. Racemes 1–2 dm. long, several-flowered, the pedicels and calyx slightly glandular-puberulent. Calyx tube about 5 mm. long, the teeth 2–3 mm. long. Corolla 13–16 mm. long. Pods 3.5–6 cm. long, 4–5 mm. wide.

TYPE: mountain valleys beyond the pass of the Limpia (Texas, prob-

ably near Alpine, Brewster County), *Charles Wright 138*, collected in 1849 (GH, isotype GH).

HABITAT: dry hills, mesas, and rolling plains, up to about 4,600 ft.

RANGE: from the Petrified Forest, Apache County, Arizona, southeastward through southwestern New Mexico to Trans-Pecos Texas and northeastern Chihuahua.

SPECIMENS EXAMINED:—**Arizona.** APACHE COUNTY: Petrified Forest, July 4, 1936, *Toole & Goodding* s.n. (US). **New Mexico.** DONA ANA COUNTY: mesa west of the Organ Mts. (Tortugas Mt.), August 19, 1906, *E. O. Wooton* s.n. (ARIZ, MO, RM); Tortugas Mt. southeast of Las Cruces, 4,600 ft., July and August 1906, *Wooton & Standley* s.n. (US). GRANT COUNTY: Telegraph Mts., August 16, 1902, *E. O. Wooton* s.n. (US). LUNA COUNTY: between Frontera and Mimbres, July 1851, *C. Wright 962* (GH, US). **Texas.** Without definite locality: *Sutton Hayes 159* (GH); prairie near foot of Capote Mt., October 1883, *V. Havard* s.n. (US). BREWSTER COUNTY: mountain valleys beyond the pass of the Limpia, August 1849, *C. Wright 138* (type GH); rare on Sul Ross College Hill, Alpine, August 12, 1937, *B. H. Warnock T429* (GH, US). CULBERSON COUNTY: Guadalupe Mt., in 1881, *V. Havard 51* (GH); calcareous stony soil, banks and slopes along Pine Springs Canyon, Guadalupe Mts., July 21, 1943, *U. T. Waterfall 5240* (GH, MO). HUDSPETH COUNTY: light gray calcareous soil in grassy flat between low hills approaching Sierra Diablo Plateau, 11½ miles north of Allamore, July 28, 1943, *U. T. Waterfall 5350* (GH, MO); igneous cliffs in the Eagle Mts., about 2,000 ft. above Quitman Valley, southeast of the old Love Ranch, about 35 miles southeast of Sierra Blanca, August 22, 1946, *U. T. Waterfall 6717* (GH. MO), JEFF DAVIS COUNTY: Goat Canyon, Geo. Jones Ranch, Davis Mts., about 5,000 ft., July 16, 1936, *L. C. Hinckley* s.n. (ARIZ, GH); Goat Canyon, Mt. Livermore, July 30, 1935, *L. C. Hinckley 423* (F). **Mexico. Chihuahua:** near Lake Encinillas north of Chihuahua, August 21, 1846, *A. Wislizenus 126* (MO, fragment GH).

### 4. **Peteria glandulosa** (A. Gray) Rydb.

*Peteria scoparia* var. *glandulosa* A. Gray ex S. Wats., Proc. Am. Acad. **17:** 342. 1882.
*Peteria glandulosa* (A. Gray) Rydb. N. Am. Fl. **24:** 183. 1923.

Sprawling herb from a thick tuberous root, with divaricately branched pubescent stems mostly 1–3 dm. long. Leaves 1.5–3 cm. long, the leaflets mostly 9–15, narrowly elliptic, 1–3(–4) mm. wide, 2–5(–8) mm. long, very short-petiolulate, with a dark and strigose midrib and strigose margin, the pairs of leaflets 1–3 mm. distant from each other. Stipules a pair of divaricate setose spines 3–10 mm. long. Inflorescence a terminal raceme, mostly 6–16 cm. long, about 3–5-flowered, the lowest flowers from leaf-axils and a pair of stipular spines, the others from slender bracts, the pedicels and calyx, and often the axis of the raceme, densely glandular-puberulent. Flowers about 14–15 mm. long, the calyx-tube 7–8 mm. long, the lanceolate teeth 4–5 mm. long. Pods linear, straight or slightly constricted between the seeds, the body 4–4.5 cm. long, the maximum width 3–5 mm., and with a stipe 5–6 mm. long. Seeds about 5 per pod.

TYPE: Mexico, San Luis Potosí, in arenosis circa urbem, in 1876, *J. G.*

*Schaffner 834* (GH, isotype US); paratype from the same locality in 1878, *Parry & Palmer 172* (GH).

HABITAT: dry, often calcareous hills and slopes.

RANGE: Mexico, from southern Zacatecas and San Louis Potosi to Puebla.

The geographic isolation, as well as the low aspect of the plants and their persistent leaflets, both seem to indicate specific rather than varietal rank for this plant.

SPECIMENS EXAMINED:—**Mexico. San Luis Potosí:** San Luis Potosí, in arenosis circa urbem, in 1876, *J. G. Schaffner 834* (type GH, phototype RM); same locality, in 1878, *Parry & Palmer 172* (paratype GH). **Puebla:** La Canada near Tehuacan, dry calcareous slopes, August 7, 1897, *C. G. Pringle 7482* (F, GH, MO, US); El Riego, July 1905, *Purpus 1188* (F, GH, MO). **Queretaro:** hills, San Juan del Rio, July 12, 1896, *C. G. Pringle 7285* (GH). **Zacatecas:** on mesas in dry ground, Ojo Caliente, April 30, 1892, *M. E. Jones 143* (US).

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# A NEW SPECIES OF STREPTANTHUS

GEORGE J. GOODMAN

**Streptanthus squamiformis** Goodman, sp. nov. Herba annua, saepe 0.5 m. alta in anthesi ad 1 m. alta in fructu, simplex vel interdum inflorescentia ramosa; foliis caulinis integris, ovatis, acutis, amplexicaulibus, glabratis; pedicellis ad maturate crassis ascendentibus fere rectis, usque ad 13 mm. longis, pilis late-patentibus crassis quidem prope receptaculum; calyce purpurello, 6–8 mm. longo, sepalis acutis ad apicem intro cucullatis, saccatis, capillatis, capillis densis conspicuis lucidis, 1–2 mm. longis, cylindricis, 0.12–0.18 mm. crassis in siccatione longitudinaliter complanatis squamoideis processis; petalis 12–14 mm. longis, ungulatis, lamina amplis purpureis, 6–7 mm. latis; staminibus liberis, antheris sagittatis apiculatisque; fructibus glabris, usque ad 14.5 cm. longis, 3 mm. latis; seminibus circa 60, oblongis, alatis, 3–3.3 mm. longis.

**Streptanthus squamiformis** Goodman, n. sp. Annual plants, often 0.5 m. tall in flower and up to 1 m. in fruit, simple or sometimes branched in the inflorescence; stem leaves entire, ovate, acute, clasping, glabrate; pedicels, at maturity, thick, ascending, nearly straight, up to 13 mm. long, with wide-spreading thick hairs at least near the receptacle; calyx purplish, 6–8 mm. long, sepals acute and hooded near the apex within, saccate, abundantly covered with conspicuous, clear hairs, these 1–2 mm. long, cylindric, 0.12–0.18 mm. thick, drying to longitudinally flattened scale-like processes; petals 12–14 mm. long, clawed, the broadened blade purple and 6–7 mm. wide; stamens free, anthers sagittate and apiculate; fruits glabrous, up to 14.5 cm. long, 3 mm. wide; seeds about 60, oblong, winged, 3–3.3 mm. long.

OKLAHOMA: McCurtain County: *Goodman 5507*, slopes of pine-oak forest, Beaver's Bend State Park, April 27, 1952 (Type, Bebb Herbarium of University of Oklahoma); *M. Hopkins* and *A.* and *R. Nelson 385*, Beaver's Bend State Park, May 20, 1944; *Little and Olmstead 74*, pine-oak area, north of Broken Bow, along Highway 21, June 6, 1930. ARKANSAS: Polk County: *Cooley R-23*, on sandstone and soft shale, Rich Mountain, east of Mena near Oklahoma line, May 13, 1944.

The April collection is in flower, the three May and June collections in fruit. The three collections other than the type were distributed as *S. maculatus*, to which the new species is closely related. The new species belongs, then, to the section Eustreptanthus, or Streptanthus as defined in a very narrow sense by O. E. Schulz in Die Natürlichen Pflanzenfamilien 17 b: 300. 1936.

The type collection was obtained from a population of plants that extended over an area of perhaps a hundred square yards. Over seventy plants were taken and a similar number were collected by Prof. U. T. Waterfall. The plants were very uniform, the color of the vegetative parts, the leaf shape, the flower color, and the hairs on the calyces showing little or no variation. No plants of the related *S. maculatus* were seen on this trip. In flower the new species is quickly recognized by the conspicuous hairs on the calyces which, upon drying, resemble scales. In fruit, at least a few of these scale-like hairs may be found on the thick pedicels.—DEPARTMENT OF PLANT SCIENCES, UNIVERSITY OF OKLAHOMA, NORMAN, OKLAHOMA.

*Volume 58, no. 695, including pages 311–334, was issued 10 December, 1956.*

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## ERRATA

Page 149, line 35; for **Meyerii** read **Meyeri.**
Page 150, line 1; for *Meyerii* read *Meyeri.*
Page 151, lines 40, and 44; for *Meyerii* read *Meyeri.*
Page 208, line 4; for *paqe* read *page.*
Page 268, line 1; *for* 8a. *read* 8b.
Cover No. 695, line 7; for **Praematurus** read **praematurus.**
Cover No. 695, line 10; for **Americana** read **americana.**
Page 315, line 24; for **serotinum** read **serotina.**

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